

IN THE UNITED STATES DISTRICT COURT  
FOR THE WESTERN DISTRICT OF MICHIGAN  
SOUTHERN DIVISION

UNITED STATES OF AMERICA,

Plaintiff, No. 1:17cr130

vs.

DANIEL GISSANTANER,

Defendant.

Before:

THE HONORABLE JANET NEFF,  
U.S. District Judge  
Grand Rapids, Michigan  
Wednesday, May 24, 2018  
Motion Proceedings, Volume II

APPEARANCES:

MR. ANDREW BIRGE, U.S. ATTORNEY  
By: MR. JUSTIN PRESANT  
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On behalf of the Plaintiff;

FEDERAL PUBLIC DEFENDERS  
By: MS. JOANNA CHRISTINE KLOET  
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On behalf of the Defendant.

REPORTED BY: MS. KATHY J. ANDERSON, RPR, FCRR

May 24, 2018

PROCEEDINGS, 9:15 a.m.

THE LAW CLERK: All rise. Court is back in session.  
Please be seated.

THE COURT: Good morning, everybody.

MS. KLOET: Good morning.

THE COURT: I apologize for the late start. I had a  
little problem with my computer.

This is the second day of an evidentiary hearing in  
case number 1:17cr130, the United States versus Daniel  
Gissantaner. Counsel are present, the defendant is present.  
Mr. Present, are you prepared to put Ms. Smith back on the  
witness stand?

MR. PRESANT: Yes, Your Honor. The government's  
direct has concluded, but Ms. Smith is here in the courtroom  
prepared to submit to cross-examination.

THE COURT: Thank you. Ms. Smith, you're still under  
oath.

CROSS-EXAMINATION

BY MS. KLOET:

Q Good morning.

A Good morning.

Q I'm pulling up Defense Exhibit I. Do you recognize this  
document?

A Yes, this is one of the electropherograms that I generated.

## AMBER SMITH - CROSS EXAMINATION - MS. KLOET

1 Q And I have it up just to help us with the first segment of  
2 questions to cover some basic DNA concepts. Each individual  
3 carries typically two alleles at each locus, correct?

4 A Yes.

5 Q One from mother, one from father?

6 A Yes.

7 Q Is it possible for someone to carry three?

8 A Yes.

9 Q Is it possible for a single individual to have the same two  
10 alleles at one singular locus?

11 A Yes.

12 Q Okay. So it could be like a 15 and a 15 at D2, for  
13 instance?

14 A Yes, that's a homozygote. H-O-M-O-Z-Y-G-O-T-E.

15 Q Thank you. And that would appear on any PG like this one  
16 not as any two different 15s but as a larger amount of a single  
17 15, is that fair to say?

18 A Yes, like at D16 there's just one peak that has an 11.

19 Q Okay. Thank you. And two individuals can have the same  
20 alleles at a particular locus, right?

21 A Yes.

22 Q Okay. So two different people could be a 12 and a 15 at  
23 one single locus.

24 A Yes.

25 Q Okay. And if they are in the same mixtures all you would

## AMBER SMITH - CROSS EXAMINATION - MS. KLOET

1 see at that locus is a 12 and a 15, right?

2 A Yes.

3 Q When you look at an EPG, when you're dealing with a mixture  
4 you can't tell with 100 percent certainty if a particular  
5 allele at one locus was contributed by the same individual who  
6 contributed, say, a 15 at another locus, right?

7 A Say that again, please.

8 Q Can you tell whether or not one allele at locus A was also  
9 -- is connected to another allele at locus B, for example?

10 A Each locus is looked at individually.

11 Q Can you tell whether the same contributor contributed two  
12 different alleles at two different loci?

13 A Yes, you examine each locus individually and then take the  
14 profile and as a whole and examine it overall.

15 Q Can you tell that with absolute certainty?

16 A There is never any absolute certainty.

17 Q Are you considering the weights when you're making that  
18 determination, whether the same individual contributed X and Y  
19 at two different loci?

20 A Yes.

21 Q Thank you. Talk a little bit about amplification. In the  
22 copying or amplification process some pieces of DNA copy better  
23 than others, right?

24 A Yes.

25 Q Okay. So you might just by chance have more of one

## AMBER SMITH - CROSS EXAMINATION - MS. KLOET

1 particular piece of DNA copied than another piece in the final  
2 amplified product.

3 A Yes. Generally the smaller loci amplify better than the  
4 larger loci. And it's based on the size.

5 Q Okay. That might result in a different proportion of each  
6 particular piece of DNA?

7 A Potentially, which is why you look at the profile as a  
8 whole.

9 Q Okay. I think that's a different concept, right, than  
10 stutter that we covered yesterday?

11 A Stutter is an artifact, yes.

12 Q And that happens during the copying, as a result of the  
13 copying process?

14 A Yes.

15 Q Okay. Thank you. During your interpretation an analyst or  
16 you as an analyst aren't actually seeing the tiny little base  
17 pairs of the DNA, correct, the little through the microscope?

18 A No, I'm looking at the printout.

19 Q Okay. Thank you. I have Defense Exhibit L on the screen.  
20 Do you recognize it?

21 A These are the worksheets that were generated by Ms. Urka,  
22 the original analyst when she performed the DNA analysis.

23 Q Can you tell by looking at the information in these pages  
24 how much approximately total DNA there was in this sample?

25 A 0.2344-nanograms.

## AMBER SMITH - CROSS EXAMINATION - MS. KLOET

1 Q Okay. Nanograms, is that within a certain quantity or is  
2 that just --

3 A Nanograms per microliter.

4 Q Okay. How many nanograms total do we have of DNA here in  
5 this sample? And I'm looking at page I guess it's marked page  
6 1 but it's about five pages into the document.

7 A If you look at the number on there it does state that  
8 there's 0.2344-nanograms per microliter. We when we amplify  
9 shoot generally for around .7-nanograms or .75 and we amplify  
10 15 microliters based on our protocols. And I believe Ms. Urka  
11 most likely amp'd around close to 3 microliters.

12 MR. PRESANT: I'm sorry, Your Honor. Ms. Kloet, would  
13 you mind just pointing to what part of that page you're looking  
14 at. I'm having trouble finding it.

15 MS. KLOET: Sure, no problem. I'm looking at it's  
16 marked page 1 but actually it's page 5 of the PDF. And three  
17 lines up where it's marked LS15-377. I believe that's  
18 corresponding to the sample in this case, correct? Would that  
19 be considered overall a low amount that you're dealing with?

20 THE WITNESS: No.

21 BY MS. KLOET:

22 Q Okay. I believe your testimony yesterday indicated that  
23 the majority of the DNA indicated it came from or was female,  
24 right?

25 A Yes.

## AMBER SMITH - CROSS EXAMINATION - MS. KLOET

1 Q Okay. Can you tell approximately, you can use a calculator  
2 if you need to, what was the proportion of female to male DNA  
3 in this mixture?

4 A It's actually on the same page.

5 Q Okay.

6 A If you look at the blue column, it shows that there was  
7 about 0.0370 nanograms of male present in this sample, and then  
8 if you look at the auto over Y column it shows that that  
9 proportion was about 6.336.

10 Q Okay. Approximately how many male cells are we talking  
11 about in an amount of that size, do you know?

12 A No, I do not know.

13 Q How many nanograms are in a cell?

14 MR. PRESANT: Objection. Nanograms of what?

15 MS. KLOET: Nanograms of DNA would be in a single  
16 cell.

17 THE WITNESS: I have no idea.

18 BY MS. KLOET:

19 Q Okay. If I told you, if I guessed it was .006 would you  
20 think that would be about accurate based on your experience as  
21 a forensic analyst?

22 A If that's what you say. I don't know for sure.

23 Q We can move on. Would you mind pulling up the policy  
24 manual, Government 11. MSP has set several guidelines for  
25 using the genetic analyzer, haven't they?

## AMBER SMITH - CROSS EXAMINATION - MS. KLOET

1 A Yes.

2 Q One of those guidelines has to do with injection time,  
3 correct?

4 A Yes.

5 Q Okay. What is that?

6 A The injection time?

7 Q Yes.

8 A That's the amount of time that the sample is actually going  
9 through the process to have it separated. Our standard  
10 injection time is set at 18 seconds. Sometimes if your DNA  
11 appears to be blown out you can inject it at a lesser time  
12 which would be the ten second injection. If you would like to  
13 try to bring your peaks up to a higher height, you inject it at  
14 28 seconds.

15 Q Okay. The 28 seconds injection period was used in this  
16 case, right?

17 A I believe so, yes.

18 Q I have the EPGs that were generated in this case that you  
19 were just looking at back on your screen. Exhibit I if you  
20 would like to look at the paper document. It was your  
21 testimony yesterday that the saturation threshold for a person  
22 who is engaging in the STRmix analysis or an analyst is 25,000,  
23 is that correct?

24 A That's to run through the software.

25 Q Okay. And then if you could take a look at D8 in this



## AMBER SMITH - CROSS EXAMINATION - MS. KLOET

1 particular sample in the STRmix report. We were discussing  
2 that yesterday. I believe you testified there was, you  
3 determined there was saturation at this locus, true?

4 A Yes.

5 Q Okay. The largest RFU figure out of those three loci is  
6 23,821. Right?

7 A Yes.

8 Q That's under 25,000.

9 A Yes.

10 Q So although it was under the saturation, the 25,000 you  
11 determined that there was saturation at this particular peak  
12 based on your individual judgment?

13 A Saturation is not just determined by how high I can get my  
14 peaks. I also testified that I prefer my peaks the highest be  
15 around 20,000 RFU because once you get over a certain RFU you  
16 start to see excessive artifacts in the sample, whether they be  
17 given allele calls or they be given off ladder calls. So  
18 that's a judgment call and a determination. And Ms. Urka was  
19 not trained in the STRmix software or what things are that you  
20 look at regarding a STRmix analysis. So she would be unaware  
21 that this may potentially be an issue when you're engaging in  
22 determining number of contributors and running things through  
23 the software.

24 Q Okay. So that was fair to say a judgment call based on  
25 your experience and training and education as an analyst, true?

## AMBER SMITH - CROSS EXAMINATION - MS. KLOET

1 A Yes.

2 Q Okay. You also testified that you create a different EPG  
3 for STRmix purposes than the one that was initially created by  
4 the first analyst, right?

5 A Yes.

6 Q And this before you right now is that EPG that you created  
7 for STRmix purposes, right?

8 A Yes. It has my initials on it.

9 Q Okay. Thank you. So if you could take a look at the locus  
10 right next to D8. There are 1, 2, 3, 4, 5, 6, 7 allele present  
11 here, right?

12 A Yes.

13 Q At least as displayed on the EPG.

14 A Yes.

15 Q Okay. And I think your testimony yesterday was by removing  
16 the filters that were present on that first EPG you can see all  
17 of these that you see here in this second STRmix EPG, right?

18 A Yes. By removing the stutter filters, the stutter peaks  
19 now become visible.

20 Q I think your testimony earlier was that typically a human  
21 individual donates two alleles at each locus, true?

22 A Yes.

23 Q So if we have 7 here it's possible that might be a fourth  
24 contributor.

25 A The number of contributors is determined by what is an

## AMBER SMITH - CROSS EXAMINATION - MS. KLOET

1 artifact. So if you look at the other EPG that was generated  
2 by Ms. Urka, those were deemed to be artifacts based on our  
3 stutter thresholds. So those would be filtered out anyway. So  
4 you are potentially correct, there could be I guess four  
5 contributors there based on the artifacts that are present.  
6 But STRmix also has those stutter thresholds incorporated into  
7 the software that meet our stutter threshold guidelines. And  
8 it does determine the potential ability for it to be a real  
9 type or an artifact type. Which is why you then in turn look  
10 at the genotype combination breakdown in the STRmix files.

11 Q So your conclusion is a product of a lot of different I  
12 guess parameters in your analysis.

13 A Yes.

14 Q Okay. With respect to STRmix specifically, I believe  
15 Mr. Nye testified that the state police started using STRmix in  
16 March of 2016, does that sound accurate to you?

17 A Yes.

18 Q Okay. When was the STRmix run in this case?

19 A I generated these EPGs on June 2nd of 2016. And the STRmix  
20 reports were generated on June 2nd in 2016 as well. So that's  
21 when they were run.

22 Q Okay. And just so the record reflects, you're referring to  
23 Defense Exhibit J to determine when they were run, right?

24 A Yes.

25 Q Okay. Thank you. Sorry about that. Yesterday towards the

1 end of the day you testified that you had been using the  
2 likelihood ratio as far back as 2006. Right?

3 A Yes.

4 Q Were you using it on complex mixtures of DNA or were you  
5 using it in another context?

6 A Both. I have used it for paternity, and I am one of the  
7 paternity analysts in Michigan so I do use it routinely here.  
8 And in St. Louis we used them mostly on intimate samples  
9 regarding sexual assaults where you can condition on the  
10 victim. So it would be a mixture of more than one person,  
11 could routinely be three or four people because you can  
12 condition on the victim.

13 Q And you were presenting a likelihood ratio in St. Louis in  
14 those cases?

15 A Yes.

16 Q Did you use them more frequently in the paternity  
17 situation?

18 A No. Because paternities are generally only run in criminal  
19 cases and there are a lot more sexual assaults that occur than  
20 criminal paternities. So they actually would be presented  
21 quite often based on sexual assaults. And they could be used  
22 in homicides as well because an intimate sample is considered  
23 any sample taken from the victim's body. So I can condition on  
24 the victim and assume those victims types are present. Which  
25 is part of a likelihood ratio which would be used.

## AMBER SMITH - CROSS EXAMINATION - MS. KLOET

1 Q So when you say you assume that victim is present, that's a  
2 conditioning profile like you referenced earlier, right?

3 A Yes. Meaning that as part of that mixture the victim is  
4 present in the mixture, and I'm assuming that makes sense, it's  
5 from her body part.

6 Q Okay. That type of information would assist you in making  
7 your analysis if you had a conditioning profile such as the  
8 victim in that case, right?

9 A Yes.

10 Q The more information -- your analysis is only as good as  
11 the information you get, fair to say?

12 A Yes.

13 Q Thank you. Refer to Defense Exhibit B, please. Do you  
14 recognize this document?

15 A I do. This is the report I generated for this case.

16 Q Okay. And do you set forth a likelihood ratio in this  
17 particular case?

18 A I do.

19 Q So likelihood ratio in a nutshell based on your testimony  
20 from yesterday gives two different scenarios of factual  
21 possibility?

22 A Yes. It's two different ways to consider the evidence.

23 Q Okay. And you choose the scenarios, right?

24 A Yes.

25 Q And here they were H1 and H2 as referenced on the first

## AMBER SMITH - REDIRECT EXAMINATION - MR. PRESANT

1 page in the chart?

2 A Yes.

3 Q The first one is the probability that the profile of Daniel  
4 Gissantaner and two unrelated, unknown contributors.

5 A Correct.

6 Q The second one is the probability of that mixture having  
7 three unrelated, unknown individuals.

8 A Yes.

9 Q And that was based on your estimation of the number of  
10 contributors being three.

11 A Yes.

12 Q Thank you. If you were to increase the number of  
13 contributors four to five, with everything else remaining the  
14 same, it could potentially change the likelihood ratio,  
15 couldn't it?

16 A It absolutely would change the likelihood ratio.

17 Q And it could either increase it or it could reduce it  
18 potentially.

19 A Potentially.

20 MS. KLOET: Thank you. That's all I have, Your Honor.

21 THE COURT: Thank you. Any redirect, Mr. Presant?

22 REDIRECT EXAMINATION

23 BY MR. PRESANT:

24 Q Thank you, Your Honor.

25 THE COURT: Did you intend to offer Exhibit L?

## AMBER SMITH - REDIRECT EXAMINATION - MR. PRESANT

1 MS. KLOET: I'm sorry, Your Honor. Yes, I would move  
2 to -- if the exhibit isn't admitted already from yesterday, I  
3 move to admit the exhibit. L, I think -- so L, yes, and V  
4 which was already in there by the prosecution. V as in Victor.  
5 The government already admitted that same report yesterday. I  
6 can admit it a second time or move to admit it a second time if  
7 you wish.

8 MR. PRESANT: So L and V are being offered?

9 MS. KLOET: L and V, yes.

10 MR. PRESANT: No objection.

11 THE COURT: They are admitted.

12 BY MR. PRESANT:

13 Q Ms. Smith, Ms. Kloet asked you some questions a few moments  
14 ago about whether or not you could visually see the molecules  
15 moving through the capillary electrophoresis in the genetic  
16 analyzer. Do you recall those questions?

17 A Yes.

18 Q You answered no, you couldn't see them.

19 A Yes.

20 Q Have you ever been able to visually see molecules before?

21 A No.

22 Q Why is that?

23 A They are less than microscopic. You can't -- that's why  
24 you have instruments to be able to detect and the methods to be  
25 able to detect the DNA present and separate it because it is so

## AMBER SMITH - REDIRECT EXAMINATION - MR. PRESANT

1 miniscule.

2 Q They are smaller than can be detected by the human eye, is  
3 that correct?

4 A Yes.

5 Q Are you concerned as a scientist if you're working with  
6 molecules that you can't actually see with your own eyes?

7 A No.

8 Q Why not?

9 A Because these processes have been used for years and  
10 validated for years to be acceptable. And these are common  
11 practices in my field.

12 Q You're only building on the scientific work that has come  
13 before you in the hundreds of years that humans have been  
14 working on chemistry?

15 A Yes.

16 Q Ms. Kloet also asked you some questions about the quantity  
17 of DNA, the quantitation when you looked at Ms. Urka's  
18 worksheet. Do you recall those questions?

19 A Yes.

20 Q I want to ask you an open question with respect to  
21 quantity. When you quantitate DNA, not in this case, you  
22 didn't do the quantity in this case, correct?

23 A Correct.

24 Q But when you do the quantitation in other cases, what  
25 significance, if any, does the quantity of DNA you find have



## AMBER SMITH - REDIRECT EXAMINATION - MR. PRESANT

1 for your analysis?

2 A The quantitation step is just an estimation of how much DNA  
3 is potentially a part of the sample. The only thing it tells  
4 me is a ball park region that's present so I know how much to  
5 amplify. So we shoot, or I shoot for about .7-nanograms per  
6 microliter. So if I have a zero, I'm going to amp all 15  
7 microliters and try to get the best I can even though I may not  
8 most likely get anything. But we do not stop at quant. So no  
9 matter how low or high the value is, that sample is always  
10 taken forward. So I may also have a sample that quantifies which  
11 is typical for a known sample around 10 or 11-nanograms per  
12 microliter. Which then I still shoot for the same amount to go  
13 into my amplification to generate a profile.

14 Q Does the quantity of DNA detected in the lab give you any  
15 information about how the DNA got on to the evidentiary sample  
16 from which it was collected? Strike that. The evidentiary  
17 item from which it was collected?

18 A No.

19 Q And why not?

20 A It's just I can't tell you how the DNA got there. I'm just  
21 analyzing the sample that I have and can say whether or not the  
22 DNA was present.

23 Q Ms. Kloet also asked you some questions regarding the  
24 25,000 RFU in the manual and your preference for 20,000 for  
25 doing STRmix analysis. You recall those questions?

## STEVEN LUND - DIRECT EXAMINATION - MS. KLOET

1 A Yes.

2 Q And it has to do with the oversaturated D8 locus that you  
3 removed in your judgment according to the policy set in place  
4 by MSP within which you could exercise that judgment, correct?

5 A Yes.

6 Q Is the significance of the removal of that locus in this  
7 case, does that strictly relate to your determination of the  
8 number of contributors?

9 A No. It has to do with the artifacts that are potentially  
10 present. Unfortunately, with D8 and the TH01 locus, when they  
11 have homozygotes at those locations they attempt to possibly  
12 exhibit oversaturation or excessive artifacts because they are  
13 smaller locations that are tested. So it would not be uncommon  
14 actually for me to have a locus like TH01 or D8 above threshold  
15 so I can gain more information at the larger loci from  
16 additional contributors. I would still ink that locus and not  
17 run it through the software because it exceeds threshold and  
18 most likely has excessive artifacts to gain more information at  
19 the larger locations tested.

20 MR. PRESANT: Nothing further.

21 THE COURT: Thank you. Any recross?

22 MS. KLOET: No, Your Honor. Thank you.

23 THE COURT: Thank you, Ms. Smith, you may step down.

24 Mr. Presant.

25 MR. PRESANT: That's the end of the evidence the

STEVEN LUND - DIRECT EXAMINATION - MS. KLOET

1 government intends to present in this proceeding, Your Honor.

2 THE COURT: Thank you. Ms. Kloet.

3 MS. KLOET: Your Honor, I reserved Dr.

4 Julie Howenstine but I think in light of Ms. Smith's testimony  
5 she is not necessary. Dr. Lund is downstairs. He was directed  
6 not to observe the testimony in this case by his employer. Can  
7 I fetch him?

8 THE COURT: Yes. Give you five minutes to do that.

9 STEVEN LUND, DEFENSE WITNESS, WAS DULY SWORN

10 THE LAW CLERK: Please be seated. And state your full  
11 name for the record.

12 THE WITNESS: My name is Steven Peder Lund.

13 DIRECT EXAMINATION

14 BY MS. KLOET:

15 Q Dr. Lund, what is your current occupation?

16 A I am a mathematical statistician at the National Institute  
17 of Standards and Technology also known as NIST.

18 Q What is NIST?

19 A NIST is a national measurement lab located in Gaithersburg,  
20 Maryland.

21 Q Is that a federal government entity?

22 A Yes. It's part of the Department of Commerce.

23 Q How long have you been in that position?

24 A A little more than six years.

25 Q What are some of your duties and responsibilities there?

## STEVEN LUND - DIRECT EXAMINATION - MS. KLOET

1 A I work with other scientists at NIST to help refine the  
2 questions they are asking, plan their experiments, analyze  
3 their data, and report their results.

4 Q Do you have any areas of special focus?

5 A I often work with the Biochemical Sciences Division, but in  
6 general, the Statistical Engineering Division in which I work  
7 is tasked with consulting with any of the scientists at NIST.

8 Q Where did you work before your current employment at NIST?

9 A I went to NIST straight from graduate school at Iowa State  
10 University where I served as a research assistant, teaching  
11 assistant, and a statistical consultant.

12 Q What did you do in those roles?

13 A So as a statistical consultant I worked with other graduate  
14 students and faculty members in refining their questions,  
15 planning their experiments, analyzing their data, and reporting  
16 their results; in a teaching assistantship, I instructed a  
17 course of about 30 students; in a research assistant I worked  
18 with my advisor to move towards publication of novel research.

19 Q Can you describe the higher education that you've  
20 completed?

21 A So I have a Ph.D. from Iowa State University in the field  
22 of statistics.

23 Q When did you complete that?

24 A January of 2012.

25 Q As part of that program did you complete a dissertation?

## STEVEN LUND - DIRECT EXAMINATION - MS. KLOET

1 A I did.

2 Q What was that dissertation topic?

3 A It was "Statistical Methods for Identifying Differentially  
4 Expressed Genes Using Hierarchical Models."

5 Q Before you completed your Ph.D., did you complete a  
6 bachelor's program?

7 A Yes, I did. I graduated majoring in math and physics from  
8 St. Olaf College in Northfield, Minnesota.

9 Q Did you graduate with any distinctions?

10 A I did. Magna Cum Laude and I received an honors in  
11 physics.

12 Q When you were enrolled in school I think you referenced  
13 some research you did. What type of research was that?

14 A At St. Olaf or at Iowa State?

15 Q Start with St. Olaf.

16 A I was part of a summer undergraduate program, research  
17 program at the University of Milwaukee. I looked at how  
18 antimony molecules deposit on gold surfaces. I was part of a  
19 positron or positronium research group in the physics  
20 department at St. Olaf in the summers.

21 Q Did you engage in any research that involved computers in  
22 any respect, programming, developing?

23 A Yeah. I was tasked with the physics research involved  
24 coding to process data coming off of the instrumentation.

25 Q Have you been a member of any professional organizations?

## STEVEN LUND - DIRECT EXAMINATION - MS. KLOET

1 A Yes. I have been a member of the American Statistical  
2 Association.

3 Q Are you an author or coauthor of any peer reviewed  
4 publications?

5 A Yes. About 25 or so.

6 Q Have any of your publications addressed genetics or DNA to  
7 any degree?

8 A Yes.

9 Q Have any of your publications addressed likelihood ratios?

10 A Yes.

11 Q While at NIST did you coauthor an article that discussed  
12 the likelihood ratio and its application or use with third  
13 parties?

14 A Yes.

15 Q Who was your coauthor for that article?

16 A Dr. Hari Iyer.

17 Q Does he also work with you at NIST?

18 A He does.

19 Q In your role at NIST or our professional capacities you  
20 held do you engage in or conduct trainings or otherwise provide  
21 assistance to practitioners in the field?

22 A Yes.

23 Q What type of -- in 2018 what type of that activity have you  
24 engaged in?

25 A We had a one-day course at a conference for pattern and

## STEVEN LUND - DIRECT EXAMINATION - MS. KLOET

1 trace evidence where we were teaching practitioners or lawyers.  
2 We had about 50 attendees for a one-day course, and we have had  
3 I think about four of those courses over the past three years  
4 or so.

5 Q The one you just referenced, was there a sponsor of that?

6 A The National Institute of Justice.

7 Q Did your coauthor, Dr. Iyer, also serve as a panelist in  
8 that?

9 A This is for the courses, right. So he was a co-instructor  
10 and then also he separately from the course participated in two  
11 different panel sessions in that same conference, and yes, we  
12 were both participants.

13 Q Okay. Thank you. In 2017 did you have any presentations  
14 that had to do with statistics and the presentation of  
15 evidence?

16 A Yes. I would say on the order of four or five, there  
17 about.

18 Q Thank you. So these presentations, are they given only to  
19 other, these type of presentations only to other scientists  
20 like yourself?

21 A In some cases there is communication with other scientists  
22 or statisticians, and in some cases it's an open presentation  
23 to practitioners or whoever attends the conference or  
24 gathering.

25 Q Are there sometimes representatives of law enforcement?

STEVEN LUND - DIRECT EXAMINATION - MS. KLOET

1 A Yes.

2 Q How about lawyers?

3 A Yes.

4 Q I'm bringing up Defense Exhibit A. Is there a binder up  
5 there?

6 A Defendant's exhibit binder?

7 Q Yes. So if you could turn to the tab that says A. It's  
8 the same thing that's displayed on your screen. Do you  
9 recognize this document?

10 A Yes, I do. It looks like my CV.

11 MS. KLOET: Your Honor, the defense moves to admit  
12 Defense Exhibit A at this time.

13 MR. PRESANT: No objection.

14 THE COURT: It's admitted.

15 BY MS. KLOET:

16 Q Dr. Lund, have you ever testified in court before?

17 A No, I have not.

18 Q I would like to ask you some general concepts or questions  
19 involving general concepts of statistics and other related  
20 topics.

21 How do you define as a statistician probability?

22 A So there are different definitions; maybe the most common  
23 one is to think of probability in terms of a long run relative  
24 frequency. So how often a particular event would occur in a  
25 large collection of repeated instances. But there is also from



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1 a subjective community articulation of probability is a measure  
2 of one's degree of belief in a particular proposition.

3 BY MS. KLOET:

4 Q So another way of putting it, would it be fair to say, it's  
5 a way to quantify someone's belief?

6 A Certainly.

7 Q In the course of your study and professional career, have  
8 you become familiar with the concept of a likelihood ratio?

9 A Yes.

10 Q Can you describe it in general terms for the Court?

11 A So as it's used in forensic science differs slightly from  
12 its technical definition in statistics. But the general sense  
13 is it's a ratio of two probabilities, so probability of some  
14 particular event or information under competing explanations or  
15 propositions. And its intent is to characterize the ratio of  
16 the plausibility of encountering that information under the  
17 competing propositions.

18 Q You indicated it was a little bit different in the  
19 forensic, in the forensic field. Could you elaborate on that a  
20 little bit?

21 A So in its strict definition from statistics, there would be  
22 only one model considered, the numerator in one and the  
23 denominator, so it's a simple hypothesis. So like you might  
24 ask is the mean zero or is the mean one. And say you have a  
25 normal distribution. And so the ratio would be what is the

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1 probability of seeing this data if the mean were zero, divided  
2 by what is the probability of seeing this data if the mean were  
3 one. However, in real applications typically you don't have  
4 two exact values to specify, and so it might be something like  
5 is the mean zero or is it not zero. And then that goes to  
6 something that would be the generalized linear, sorry, the  
7 generalized likelihood ratio, which takes the value under one  
8 assumption divided by the maximum of the likelihood under any  
9 other, any other possible instances of the alternative.

10 And in forensics it's often a base factor which  
11 represents some weighting of possible models or explanations in  
12 the numerator versus some weighted combination of multiple  
13 models or explanations in the denominator.

14 BY MS. KLOET:

15 Q Thank you for normalizing it for us non statisticians in  
16 the room to the best of your ability.

17 As a statistician what does the term scientific  
18 measurement mean to you?

19 THE WITNESS: So a scientific measurement to me means  
20 the collection of data to establish the value of some property  
21 of an object or an event. And since -- through the comparison  
22 with some, some standardized unit, some standard unit. And  
23 since the comparison to a standard unit is never perfect, it  
24 always involves some characterization of uncertainty, and that  
25 uncertainty is characterized through a collection of

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1 comparisons trying to understand the different factors that can  
2 affect its value and in providing some final estimate, not only  
3 of the value itself but how well that value is known through an  
4 uncertainty estimate.

5 BY MS. KLOET:

6 Q Thank you. Are there certain features or hallmarks of a  
7 scientific measurement?

8 A Certainly. Generally there would be a characterization of  
9 its traceability. So since measurements rarely involve direct  
10 comparison with the definition of a unit, the standardized  
11 unit, there is a traceability chain. So item A may not be  
12 compared to item C directly, but item A as compared to item B  
13 which compared to item C, each one of those comparisons  
14 involves an uncertainty. So through the chain of traceability  
15 you're trying to trace back how large the uncertainty is from  
16 each of those to get an aggregate uncertainty.

17 There is also assessments of repeatability and  
18 reproducibility, where repeatability is what is the variability  
19 of the results obtained when we repeat the measurement process  
20 in a similar circumstances as possible. So like the same  
21 person doing the same measurement on the same day using the  
22 same machine; and reproducibility might be when a different  
23 person uses a different machine then what type of variability  
24 is there among the results.

25 Q Thank you. In your opinion would you characterize a

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1 likelihood ratio as a scientific measurement?

2 A I would not.

3 Q Why not?

4 A I have not seen in general the comparison through some  
5 standardized unit or in general thorough characterizations of  
6 things like traceability or repeatability or reproducibility.

7 Q When one is using the likelihood ratio or generating one is  
8 there a hard limit or a maximum figure?

9 A Infinity.

10 Q You testified earlier that you coauthored an article this  
11 past fall while in your capacity at NIST, correct?

12 A Yes.

13 Q Okay. If you could turn to tab Q in your binder. Does  
14 this appear to be the article that you're referring to?

15 A Yes, it does.

16 Q You also indicated that you coauthored this with Hari Iyer.  
17 You work closely with Dr. Iyer?

18 A I do.

19 Q Did you and Dr. Iyer take the same position in that paper?

20 A We did.

21 Q What position was that?

22 A We expressed some potential concerns over the use of  
23 likelihood ratios based on our perceptions of the  
24 recommendations or usage in the community and the understanding  
25 from practitioners in the field. In particular, we were

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1 concerned over potential message that the community understands  
2 that if they do not characterize the evidence, if their  
3 explanation of the evidence does not include a characterization  
4 of the likelihood ratio that they are doing something wrong.  
5 Or that in some instances arguments have been made that a  
6 likelihood ratio if given should not contain a measure of  
7 uncertainty. And those are not consistent with our  
8 understandings of the principles of measurement science or of  
9 transferring information from one party to another.

10 Q Thank you. Early on in your testimony you referenced  
11 something called Bayes theorem. Do you discuss that theory in  
12 this article?

13 A We do.

14 Q What is it? How does it work?

15 A So maybe it would be helpful to break that into two parts.  
16 So Bayes theorem is a property of probability theory that  
17 dictates how one can update their current beliefs over, maybe  
18 -- we should start by there. Some aspect about which a person  
19 has uncertainty and they may have an initial collection of  
20 weights or plausibilities for each of those potential states of  
21 nature. And then upon encountering new information Bayes  
22 theorem provides constraints about how their understanding of  
23 how often that information could occur under each of the  
24 potential states of nature influences their subsequent  
25 perception that that state of nature is true. So how do you

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1 update your beliefs in new information.

2 The article talks more about Bayesian decision theory,  
3 which then goes maybe to the second aspect of this which is if  
4 you have what your probabilities are across the different  
5 states of nature, so the different potential reality is that  
6 some aspect important to the decision you're going to make may  
7 have, and you have a collection of actions that you might take,  
8 so for decisions that you might make, and for each combination  
9 of what truth might be and action you might take, what  
10 consequence or reward you might receive; and so then Bayesian  
11 decision theory says after you've assigned a probability to  
12 each of these states of nature and a consequence for each of  
13 the states of nature under what action you might take, you  
14 should pick the action that gives you the best average reward  
15 or at least average consequence.

16 Q Thank you. That's a mouthful.

17 Does your article address the decision making  
18 processes that are involved in criminal and civil cases?

19 A It does.

20 Q Including the findings of forensic experts?

21 A It does.

22 Q In your article did you identify any concerns with using a  
23 likelihood ratio as a means of expressing evidence in court?

24 A We do.

25 Q What are they?

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1 A So one of the concerns is that the likelihood ratio by its  
2 definition as used in the subjective Bayes decision theorem is  
3 a personal value. So it's not a property of the evidence  
4 itself but it's a property of a particular individual's  
5 perception of the evidence. And the concern is that if an  
6 expert provides that value, the audience may, may feel as  
7 though that is the unique interpretation for the information  
8 presented, or they may come to expect that any reasonable  
9 characterization of the facts used in arriving at that  
10 interpretation may lead to a sufficiently similar result.

11 But the concern is that we don't, we have -- from  
12 what we've seen, we haven't seen a systematic exploration of  
13 what the range of reasonable results might be for a given set  
14 of data. And so our article proposed one framework for doing  
15 so.

16 Q Thank you. So you testified earlier that there's not  
17 necessarily one single correct likelihood ratio in a given  
18 situation.

19 A Yes.

20 Q So there may be several. Do different models potentially  
21 generate different answers or different likelihood ratios?

22 A Yes.

23 Q Okay. What do you mean by model?

24 A So when you have a collection of data, that data doesn't  
25 directly provide a probability. You then in general fit some

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1 probability model to that data to translate the data that you  
2 have into a probability. But for a given collection of data  
3 there's not one unique translation into a probability.

4 THE COURT: Okay. I'm going to interrupt. We have in  
5 this case a probability, a ratio of 49 million to 1. Okay.

6 THE WITNESS: Okay.

7 THE COURT: Based on this STRmix software operating on  
8 a DNA sample taken from a weapon. My understanding of what  
9 you've just said is that there may be other correct ratios  
10 which are not expressed as this 49 million to 1. Is that  
11 correct? Do I understand you correctly?

12 THE WITNESS: Yes, I believe so.

13 THE COURT: And I've got two questions for you. First  
14 of all, what is the subjective input that you reference, and  
15 secondly, what is the range of difference that can be  
16 introduced into the results, the LR?

17 THE WITNESS: So for the first -- so I have to state  
18 I am not an expert on probabilistic genotyping.

19 THE COURT: Well, I just want you to address the LR  
20 concept in general. You don't have to address it. I just used  
21 that as an example of what we are dealing with here.

22 THE WITNESS: Yeah. So in general when you're  
23 building a model you're trying to represent the behavior of  
24 many different aspects of a system. So from what I know just  
25 not from direct study, not from direct area of research but



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1 maybe attending some talks, in the probabilistic genotyping  
2 there are things like the drop-in rate, the drop-out rate,  
3 stutter height ratios, and each of those have maybe some  
4 behavior that you start to learn about by collecting some data  
5 on your system. But then when you're going to get to a  
6 particular output from the model, you have to choose what  
7 distribution will represent that behavior. And even when we  
8 have, you know, the more data we have we hope the smaller the  
9 range is of different reasonable representations of that  
10 behavior in the model. But we never have exactly the right  
11 representation of that behavior and so there's always a range  
12 of reasonable representations that it could be. Does that  
13 address the question? So you know we can collect more data and  
14 try to get a narrower range but there's always some range  
15 because we never exactly understand the behavior of the  
16 components of a physical system.

17 And so for the second one, I do not have the  
18 information to characterize what the range is in a particular  
19 examination for probabilistic genotyping. That hasn't been my  
20 area of study. I haven't --

21 THE COURT: I get that. Is this subjective  
22 determination affected by one's experience? For instance, you  
23 weren't here but we heard one of the scientists from the  
24 Michigan State Police lab talk about the numbers of tests that  
25 she has run on DNA, and it's not important that it was DNA, but

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1 is it your position that as an investigator's experience  
2 expands, if I've done a hundred tests I may have one objective  
3 or subjective determination, whereas if I've run 10,000 it may  
4 differ. Do I make myself clear on that?

5 THE WITNESS: Are you saying a hundred instances of a  
6 particular sample, like doing repeated measurements of the same  
7 thing or just over your career you have --

8 THE COURT: Right, right.

9 THE WITNESS: -- you have more experience.

10 THE COURT: The latter.

11 THE WITNESS: So it may be that as you get more -- so  
12 people who have done more of this have a narrower range of  
13 results. So that if you took the collection of experts who  
14 have done a hundred tests, they may agree with each other,  
15 their results may agree with each other less than those who  
16 have done 10,000 or more. You may end up get greater  
17 correspondence. I don't know the answer to that.

18 But the statement is for any given amount of data that  
19 somebody says, you know, I am representing in my model or  
20 incorporating information provided from, you know, and here's  
21 the collection of data that I'm using, there is never just one  
22 particular probabilistic interpretation that is most  
23 appropriate for that collection of data. You know, they can  
24 have their preferred methodology, the models that they are most  
25 familiar with or have been trained to apply to lead to a value,

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1 but it doesn't mean that that value is the only value. You can  
2 ask a different expert this, you know, common concept that if  
3 you ask a group of ten statisticians to evaluate a given data  
4 set, you'll get 20 different answers. Because it's difficult  
5 to try to identify one particular approach as uniquely  
6 appropriate for a given collection of data.

7 THE COURT: Okay. Thank you.

8 BY MS. KLOET:

9 Q Your testimony with me just before the other questioning we  
10 were talking about whether different models can generate  
11 different answers. I think you've answered that, but just for  
12 purposes of continuity, can they?

13 A Yes.

14 Q Can the same model generate a different answer?

15 A So the same modeling framework with different tuning  
16 parameters could or if it's the result of, you know, it  
17 involves some complex integration so they rely on simulation to  
18 evaluate its fit, it could have different answers.

19 MS. KLOET: May I approach the witness, Your Honor?

20 THE COURT: Yes.

21 BY MS. KLOET:

22 Q I just handed you what's been marked as Defense Exhibit MM.  
23 Have you seen this before?

24 A This was sent to me about a day ago. Maybe it was two  
25 nights ago. So, yes, I have seen it.

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1 Q Did you have an opportunity to review it?

2 A I have reviewed points that I was -- that were highlighted  
3 to me in an overview e-mail.

4 Q What is your understanding of the opinion expressed in this  
5 article or the results of this opinion?

6 A Well, so the part of the article --

7 MR. PRESANT: I'm going to object, Your Honor. The  
8 witness hasn't testified to who sent it to him or what points  
9 they asked him to review, and I think that's important  
10 especially given the limited scope of his testimony here today  
11 based on what he understood prior to receiving the subpoena in  
12 this matter.

13 THE COURT: Well, I also think we need to have some  
14 foundation in terms of where the article is from, if it's a  
15 journal, apparently it is, and at the very minimum, the title  
16 of the article. Dr. Lund, are you familiar with Forensic  
17 Science International Genetics?

18 THE WITNESS: I have reviewed an article for the  
19 journal once previously.

20 THE COURT: Okay. So you are familiar with this  
21 journal.

22 THE WITNESS: I have heard of the journal before.

23 THE COURT: And does it generally include peer review  
24 research papers?

25 THE WITNESS: It's my understanding, yes, that was my

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1 role for the interaction with the journal was to be a peer  
2 reviewer.

3 THE COURT: And what is the topic of this particular  
4 article that you were asked to review? This one, not the one  
5 that you reviewed for the journal.

6 THE WITNESS: So it looks like this is akin to an  
7 inner lab trial. So in measurement science often you try to  
8 get an understanding for how well a value is known or  
9 understood by sending, asking different organizations or  
10 institutions to evaluate the same property of a common sample.  
11 So like you might take some solution, mix it up really well,  
12 take aliquots or part of that, send it off to different  
13 organizations and ask them to characterize some concentration  
14 and they report back with a value that they arrive at using  
15 their measurement process. And then you use that, those  
16 results to inform what's the variability or the range of  
17 interpretations from these different organizations.

18 THE COURT: Sounds like my high school chemistry  
19 class. Which is what we did. I never could figure it out. I  
20 was so far off the mark.

21 So what exactly does this article address then?

22 THE WITNESS: So the part that my attention was drawn  
23 to is in table 1 on page number 161 which the caption explains  
24 that there are different participating laboratories using the  
25 LRmixStudio software, except where marked by an asterisk, those

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1 were using different softwares for the interpretation of some  
2 DNA mixture. And then table 1 is illustrating the likelihood  
3 ratio characterization reported by those participating labs.

4 THE COURT: And they vary considerably.

5 THE WITNESS: From the results reported here, among  
6 those using the same software, the largest result says it's  
7 three times ten to the 14, whereas the smallest is 2.6 times  
8 ten to the 3. So, you know, from something that's 2600 to  
9 something that's well beyond a billion, into the trillions.

10 MR. PRESANT: May I voir dire, Your Honor?

11 THE COURT: On what?

12 MR. PRESANT: On the witness's familiarity with this  
13 exhibit and how it came to his attention.

14 THE COURT: Not right now, no. Ms. Kloet.

15 MS. KLOET: Thank you, Your Honor.

16 BY MS. KLOET:

17 Q With respect to foundation just to note for the record,  
18 Your Honor, this journal is the same journal that published  
19 government's exhibit, the article at Government's Exhibit 4.

20 THE COURT: Okay.

21 MS. KLOET: Thank you.

22 BY MS. KLOET:

23 Q You just recited some of the information, recited some of  
24 the information that's in this article. What are some of your  
25 takeaways as a statistician?

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1       A     At least in the scenario provided here that it seems like  
2       there is a range in the end results that if I were a receiver  
3       of any one of these results, it may not be consistent with my  
4       understanding of how well this value is agreed upon by the  
5       community. You know, I would want to understand what this  
6       range is when trying to interpret any one of these particular  
7       values.

8               MS. KLOET: Your Honor, I would move to admit Defense  
9       Exhibit MM.

10              THE COURT: Now you may voir dire, Mr. Presant.

11              MR. PRESANT: Thank you, Your Honor. Dr. Lund, you  
12       said Exhibit MM was e-mailed to you a day or two ago.

13              THE WITNESS: Is this, is that what the paper we have  
14       been talking about?

15              MR. PRESANT: It is, yes.

16              THE WITNESS: Yes, it was.

17              MR. PRESANT: Who was it e-mailed to you by?

18              THE WITNESS: Dr. John Butler.

19              MR. PRESANT: Dr. John Butler. And where did Dr.  
20       Butler get it from?

21              THE WITNESS: I think he monitors the literature  
22       fairly regularly, but I would presume he directly downloaded it  
23       from Forensic Science International Genetics.

24              MR. PRESANT: Was anyone else copied on that e-mail?

25              THE WITNESS: I think Hari was.

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1 MR. PRESANT: Dr. Iyer was.

2 THE WITNESS: Yes.

3 MR. PRESANT: More to the point, was anyone from the  
4 federal defender or anyone who works with them, were they on  
5 that particular e-mail?

6 THE WITNESS: On the e-mail that I received, no. But  
7 I don't know if there was any additional e-mails.

8 MR. PRESANT: What about lower down the chain, did you  
9 see if that e-mail was sent by Dr. Butler to you at the request  
10 of defense counsel?

11 THE COURT: Could somebody tell me who Dr. Butler is  
12 first of all?

13 MR. PRESANT: Will you tell the Court please who Dr.  
14 Butler is?

15 THE WITNESS: Dr. Butler is a NIST fellow, so that's  
16 the most highly recognized position you can receive at NIST as  
17 a scientist, who I believe specializes in DNA mixture  
18 interpretation but has maybe shifted towards an advisory role  
19 for the forensic science program at NIST.

20 THE COURT: Okay.

21 THE WITNESS: I think he's written a collection of  
22 textbooks on DNA mixture interpretation.

23 THE COURT: Thank you.

24 MR. PRESANT: So back to my question. Did you receive  
25 any information that Dr. Butler sent you that article in



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1 coordination with or at the request of defense counsel?

2 THE WITNESS: No indication was given on the e-mail  
3 chain that I received that there was any previous contact from  
4 the defense.

5 MR. PRESANT: So when you said an e-mail, your  
6 attention was drawn to specific points.

7 THE WITNESS: Yes.

8 MR. PRESANT: That was by Dr. Butler who is drawing  
9 your attention to those points?

10 THE WITNESS: That's right.

11 MR. PRESANT: And is it a coincidence then that  
12 defense counsel marked and showed you an exhibit that  
13 Dr. Butler just happened to send to you a day or two prior to  
14 your testimony?

15 THE WITNESS: Is it a coincidence that -- I'm sorry,  
16 can you repeat the question?

17 MR. PRESANT: Let me put it this way.

18 MS. KLOET: Object to speculation, Your Honor. I  
19 don't know where this is going.

20 THE COURT: I don't really know what the relevance of  
21 it is. What difference does it make where he got it?

22 MR. PRESANT: I'll tell you, Your Honor. I think  
23 there are a couple relevant points here. First of all,  
24 Dr. Lund is represented by counsel in connection with his  
25 appearance here today. And his counsel in communication with

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1 me told me that it was very important to the United States  
2 government that the scope of his testimony be limited to that  
3 on which he was subpoenaed which did not include this article.  
4 Because this article was first given to me last night by e-mail  
5 via --

6 THE COURT: Is there something classified or something  
7 secret about this article?

8 MR. PRESANT: No. It has to do with the scope of what  
9 he's been subpoenaed here to testify to. And he said --

10 THE COURT: He's a statistician. He is testifying  
11 about what these statistics show. These are statistical  
12 values, aren't they, in this chart, this table?

13 THE WITNESS: Reported measurements.

14 THE COURT: They are statistical values, right?

15 THE WITNESS: I think so. Yes, I would call it data,  
16 yes.

17 THE COURT: So what's the problem?

18 MR. PRESANT: Well, he hasn't reviewed it carefully  
19 and I'm curious how it came to his attention.

20 THE COURT: I don't think it makes any difference,  
21 Mr. Presant.

22 MR. PRESANT: Very well, Your Honor.

23 THE COURT: Thank you.

24 MR. PRESANT: That's all I have.

25 THE COURT: Ms. Kloet.

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1 MS. KLOET: Your Honor, has the exhibit been admitted?

2 THE COURT: Yes, it's admitted.

3 MS. KLOET: Thank you.

4 BY MS. KLOET:

5 Q Based on your research and your work in the field of  
6 statistics, specifically with like the use of the likelihood  
7 ratio, pardon me, are there other ways besides the likelihood  
8 ratio to communicate evidence to a jury?

9 A I believe so, yes.

10 Q What are some of those other ways or what would you  
11 suggest?

12 A So I would be interested in the development of alternatives  
13 that as opposed to emphasizing the interpretation of a  
14 particular individual that seek to provide, here is the body of  
15 information that we have collected through our training and  
16 experience, here are the subset of those that maybe are of  
17 similar complexity or say relevant to the case at hand, and  
18 what was the, what were the results returned by a particular  
19 process of comparison. So trying to emphasize not the  
20 self-contained meaning of any particular value, but to  
21 emphasize the relationships observed in comparison between  
22 actual data itself.

23 Q So could you summarize that a little bit?

24 A So you might, you might say, you know, what, what process  
25 was used to evaluate in this case. And whatever, in here,

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1       could be STRmix. You know, has STRmix been used in the past to  
2       analyze samples where ground truth is known? Yes. Okay. And  
3       are there instances in the, in the neighborhood of the degree  
4       of complexity maybe of this particular sample? Yes. Okay.  
5       What was the output of the system in those cases? And, you  
6       know, one of the potential concerns is that we can't collect a  
7       bunch of data for every possible scenario, but maybe what could  
8       be done is, you know, are there instances where this process of  
9       comparison was utilized in applications where the sample is  
10      more complex than the one at hand. To try to get kind of a  
11      lower bound, a lower rate of performance. So what type of  
12      results were seen in instances where this was, you know a more  
13      complex mixture. What was the performance and things where it  
14      was less complex. So then you could kind of get a bracket of  
15      the behavior of the system and then use that information to try  
16      to represent the meaning of a particular result obtained in a  
17      single application.

18      Q     Thank you. I think your summary may have been longer than  
19      your initial answer but I appreciate it.

20      A     Sorry.

21      Q     So you were just describing alternative ways to communicate  
22      evidence to a jury. Do you believe that these means have been  
23      fully -- alternative to likelihood ratios, do you believe  
24      personally that these means have been fully pursued?

25      A     I do not.

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1 Q Why not?

2 A My belief is that the community has found many strengths to  
3 the use of a likelihood ratio and that has become the  
4 predominant focus is to how do we arrive at, you know, at a  
5 likelihood ratio value we can support. And that in many  
6 instances, you know, it's seen as the role of the expert to not  
7 just say what the evidence is in an organized and  
8 understandable fashion but to go straight to what it means.  
9 And so it seems then like the at least within the statistical  
10 forensics community that emphasis is going to how do we produce  
11 a likelihood ratio value as opposed to are there other ways of  
12 explaining or presenting the information that underlies an LR  
13 characterization.

14 Q Thank you. At one point in time were you asked to, I'm  
15 sorry, Defense Exhibit P in your binder. Should be the same on  
16 your screen. P. as in Peter.

17 A Oh, P.

18 Q At one point in time were you asked to give an interview  
19 with a man named John Paul Jones?

20 A Yes.

21 Q Who is John Paul Jones?

22 A Another NIST employee who is the liaison to the  
23 International Association For Identification, and also does a  
24 lot of the coordination efforts for OSAC, the Organization of  
25 Scientific Action Committee.

## STEVEN LUND - DIRECT EXAMINATION - MS. KLOET

1 Q Okay. Is he a NIST employee?

2 A Yes.

3 Q Okay. Is this representation here, Exhibit P, is this a  
4 written record of the interview you gave? Does it reflect the  
5 interview that you had?

6 A Yes.

7 MS. KLOET: Your Honor, I would move to admit Defense  
8 Exhibit P.

9 THE COURT: Which one is it again, please?

10 MS. KLOET: P. as in Peter.

11 THE COURT: Mr. Presant, any objection?

12 MR. PRESANT: Your Honor, the government has also  
13 marked as an exhibit but part of Exhibit P is cut off on page 2  
14 on the left side. So I have no problem with it coming in but  
15 the government intends to offer the version it has marked as  
16 well.

17 THE COURT: Very well. It's admitted.

18 MS. KLOET: Thank you, Your Honor.

19 BY MS. KLOET:

20 Q Were you asked to undergo this interview after your article  
21 was published in the fall of 2017 about the likelihood ratio?

22 A Yes.

23 Q And did you change your position that you took in the paper  
24 in this interview?

25 A I don't think so, no.

## STEVEN LUND - DIRECT EXAMINATION - MS. KLOET

1 Q This paper, the likelihood ratio paper from the fall of  
2 2017, was that peer reviewed?

3 A Yes, it was.

4 MS. KLOET: One moment, Your Honor.

5 BY MS. KLOET:

6 Q I'm displaying a document marked as Government's  
7 Exhibit 28, and that's not in your binder. It's a government's  
8 exhibit that's been admitted. Do you recognize it?

9 A Yes. I also received a copy of this article about a day  
10 ago.

11 Q Okay. Have you had an opportunity to review it?

12 A I have read through it and discussed it with my coauthor,  
13 Hari, Dr. Hari Iyer.

14 Q Can you describe succinctly the content of the article?

15 A I would characterize this as a rebuttal to the paper that  
16 Hari and I had written.

17 Q How do you -- what is the rebuttal, could you summarize  
18 that?

19 A As I would characterize it, it says -- can we go to maybe  
20 the key points --

21 Q Sure.

22 A Is it possible to change the page on the --

23 Q I can give a hard copy.

24 A So as identified by the highlights section just preceding  
25 the abstract on the article, it says that everyone or all agree

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1 that likelihood ratios should not be imposed on others. That  
2 this is not current practice. That presenting both an LR and  
3 the basis for it is the current best practice. LRs should not  
4 only be assigned where adequate empirical information is  
5 available. Even when an opinion is purely subjective it should  
6 be in the form of an LR. And that the LR is the single most  
7 informative summary of evidential weight.

8 And within its contents they identify the perception  
9 of misunderstandings of current practices as well as straw man  
10 argument saying that the argument we put forth or the  
11 prospectus put forth in the article that Hari and I, Dr. Iyer  
12 and I, authored are not reflective of anyone's implementation  
13 for the usage of LR.

14 Q How do you, how would you respond or how do you respond to  
15 the criticisms that are levied against your paper in this  
16 document?

17 A Well, so it seems there's a fair amount of agreement from  
18 both sides in that everybody knows that models can provide  
19 different answers, that nobody advocates for a juror to be  
20 compelled to use the, a likelihood ratio offered by an expert  
21 as their own weight of evidence, but there's an admission or a  
22 statement that a recipient of the information has a choice  
23 whether or not to accept an expert's LR. And it writes, if I  
24 could just, this is in the conclusions, the second paragraph on  
25 page 6. "Their argument supposes that forensic scientists



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1 would impose their LR on the decision maker. In reality,  
2 however, the decision maker will only use the expert's LR if  
3 they agree or trust the experts to do better than themselves.  
4 They might defer to someone more knowledgeable but they are not  
5 obliged to do so."

6 So I agree with that statement that somebody is free  
7 to modify the information as it's presented to them or modify  
8 their interpretation of the presented information. However,  
9 the concern that we were trying to articulate in our paper is  
10 that when an authority figure expresses confidence in a  
11 particular LR value, that may give the audience an impression  
12 that any reasonable interpretation of the same collection of  
13 undisputed data or facts would result in a sufficiently similar  
14 characterization of the value.

15 And that from what we've seen, there hasn't been a  
16 presentation that would support that type of interpretation or  
17 to facilitate for the audience to understand what is the range  
18 of reasonable interpretations for a given collection of  
19 information. How far, how well do we really understand this  
20 quantity?

21 I would also -- it says, you know, that the Lund and  
22 Iyer proposal is the status quo. That's maybe a section  
23 heading on page 5. Which I interpret to be like this article  
24 that Dr. Iyer and I had authored, you know, isn't something to  
25 be concerned about because nobody is doing what they're worried

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1 about and in fact the community is already practicing or the  
2 practices of the community as commonly implemented already  
3 address the concerns identified.

4 And if I may, I would maybe dispute that claim insofar  
5 as, you know, we have been giving presentations on the order of  
6 15 to 20 over the last three years, and that has led to  
7 conversations with some of the authors of this, the paper, and  
8 we have yet to been given one instance of, you know, a  
9 transcript from testimony or an example of a report that says,  
10 you know, with a conversation, you say you want this, and we  
11 are already doing that here. Look. Does this address the  
12 concerns? Can we agree that you know we are all doing this?  
13 Over three years we don't, nobody has ever handed us. So I  
14 have not yet seen a presentation of a likelihood ratio that  
15 gives some careful consideration to the influence that modeling  
16 choices may have.

17 BY MS. KLOET:

18 Q Thank you. I would like to address the concept of  
19 validation in science. Scientifically speaking, what is  
20 validation from your perspective?

21 A So I would say validation comes about, you have some, you  
22 have some theory or proposal and validation comes from  
23 conducting a sequence of tests where your theory or proposed  
24 representation has an opportunity to be disproved or to fail.  
25 So you collect more and more information and see if that

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1 information can refute the theory or the assumptions that  
2 you're putting forth. And the community may have some  
3 threshold that they decide upon where if you passed so many  
4 validation tests we consider that theory or model to be  
5 validated. In a binary declaration as opposed to here's what  
6 the validation information that we have is to support they  
7 might say this model has been validated.

8 Q Thank you. If a single model purports to have been  
9 validated as you said, does that address all the concerns you  
10 expressed in your paper from last fall?

11 A I would say no.

12 Q Why not?

13 A The question is not whether the value offered is reasonable  
14 given the data that you have, but how, how well is that value  
15 known which would be informed by what other values might that  
16 attribute have. So what is the range of results given the  
17 collection of information, not can this particular value be  
18 refuted by the collection of information considered.

19 Q If multiple models purport to have passed validation, would  
20 that address the concerns in your paper?

21 A Providing the explanation of how those models were  
22 developed and what type of independence among them, or the  
23 attempt to have a broad collection of potential  
24 interpretations, and if among those that pass validation you're  
25 getting a very stable answer, that would certainly be valuable

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1 information that our article was intended to request.

2 Q Are you aware of any research in the field that addresses  
3 the type of risks or dangers you're discussing today about  
4 using statistics such as the likelihood ratio in the courtroom?

5 A Are you talking about for studying variability or are you  
6 talking about, you know, a broader term of potential risks of  
7 --

8 Q Let me ask a different question. Are you familiar with a  
9 concept called the prosecutor's fallacy?

10 A Yes, I am.

11 Q Okay. Can you define it for the Court?

12 A So prosecutor's fallacy is a misunderstanding that when  
13 somebody speaks to the value of or the probability of the  
14 evidence under competing hypotheses or propositions, that they  
15 misinterpret it as the probabilistic characterization of the  
16 hypotheses themselves given the evidence. So they're being  
17 told the probability of A assuming B is correct but they  
18 interpret it as the probability of B assuming A is correct.

19 Q Have you ever personally observed or witnessed any, that  
20 type of issue that you just described?

21 A In my, in the interactions that I have had with other work  
22 employees at NIST, other scientists, or in the courses that we  
23 have taught, we found that this is a very common tendency.  
24 That people want to think you're providing a characterization  
25 that about the truth of the hypothesis as opposed to the

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1       plausibility of the evidence under the hypothesis, or the  
2       frequency of occurrence of the evidence under the hypothesis.

3               So I think it seems like the natural tendency is to  
4       make the prosecutor's fallacy unless it's been carefully  
5       decomposed so that a person clearly understands the distinction  
6       between the two. And that's generally my experience has been  
7       it's difficult to articulate in a short conversation even.

8       Q     So just back peddling a little bit to my earlier question.  
9       Generally speaking, are you aware of any research that touches  
10      upon that or research that touches upon risks inherent in using  
11      these type of statistics in a courtroom?

12      A     I'm aware of some research activity by Dr. William Thompson  
13      from the University of California Irvine, or Brandon Garrett, a  
14      lawyer who participates in CSafe, that are trying to study how  
15      a lay audience responds to different characterizations for  
16      weight of evidence, including the use of likelihood ratios.

17      Q     That study is underway?

18      A     They, it's certainly ongoing research. They are continuing  
19      to conduct more surveys and different means of conveying the  
20      information.

21      Q     Is there anything I haven't touched upon today that you  
22      would like the Court to know?

23      A     Not that immediately comes to mind.

24               MS. KLOET: Thank you. Pass to the prosecution.

25               THE COURT: Mr. Presant.

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

## CROSS-EXAMINATION

BY MR. PRESANT:

Q Let me start where Ms. Kloet left off. She asked you some questions about the prosecutor's fallacy, right? You weren't talking particularly about me, that's sort of a general statistical name for the fallacy?

A Yeah, that's a coined term from decades ago.

Q Is there a defense fallacy in statistics?

A I believe so.

Q An ecological fallacy?

A I believe there's a large list of fallacies.

Q Why have all these fallacies been named?

A Because they are known to have occurred, I would guess.

And that they are considered to affect the decisions that are made. They occur and they are important.

Q And it's important when you're communicating mathematical ideas to do it carefully, correct?

A Yes.

Q So if you're a witness and there were a jury in the box there, you would want to explain the statistics or mathematics you were testifying to accurately, much like you are doing today before the Court, correct?

A Yes.

Q And it's possible to describe in words statistical findings without committing those fallacies, right?

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 A Yes.

2 Q So, Dr. Lund, you are not familiar with STRmix. Well, let  
3 me rephrase that. You haven't analyzed STRmix, correct?

4 A No.

5 Q You're not here today to offer an opinion on whether STRmix  
6 is a good model or a bad model, right?

7 A No.

8 Q Well, right, your answer --

9 A Sorry, sorry. You are correct, I'm not here to  
10 characterize whether STRmix is a good model or not.

11 Q You've already testified you're not an expert in  
12 probabilistic genotyping, correct?

13 A That is correct.

14 Q Do you have an opinion here today on the use of  
15 probabilistic genotyping at all?

16 A Insofar as it represents a model, I still have the opinion  
17 that when you use a model there isn't a unique answer. I don't  
18 have anything specific to the application of probabilistic  
19 genotyping outside of it, my understanding of it being  
20 probabilistic interpretation of evidence.

21 Q So my understanding, probably worse than yours, but my  
22 understanding as a lawyer is that probabilistic genotyping  
23 isn't a model, it's a theory that can be implemented in  
24 different models, is that right?

25 A I would agree. That's consistent with my understanding.

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1 Q Okay. STRmix would be an example of one implementation of  
2 that theory in a model, right?

3 A I agree.

4 Q And you also don't have experience analyzing DNA mixtures,  
5 is that correct?

6 A Not in any human forensic context.

7 Q I appreciate that clarification. You don't have any  
8 experience analyzing human forensic samples of DNA, right?

9 A True.

10 Q Now, can we bring up Government's Exhibit 16 which is the  
11 same as I think Q. And it's a 3-page document. I'll represent  
12 to you that I have edited it down. That's the first page just  
13 because it's the cover of the magazine in which it was found.  
14 Do you recognize page 2 of Government's Exhibit 16?

15 A Yes, I do.

16 Q That's the same article we looked at before, it's just kind  
17 of a color copy, right?

18 A Yes.

19 MR. PRESANT: Your Honor, the government moves to  
20 admit 16.

21 THE COURT: Any objection?

22 MS. KLOET: I'm sorry, Your Honor. For clarification,  
23 are we admitting the first page and the second and the third?  
24 To let the Court know, my exhibit is a little bit different or  
25 Defense Exhibit Q is a little bit different in that it doesn't



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1 have the first page as mine. But I don't have any objection.

2 It looks like it's just the cover page to that issue.

3 THE COURT: Government's Exhibit 16 is admitted.

4 BY MR. PRESANT:

5 Q So if we look at -- first, Ms. Miller, can we look at this

6 paragraph right here? Mr. Jones, or is it Dr. Jones or

7 Mr. Jones?

8 A You know, I don't actually know.

9 Q I'll refer to him as Mr. Jones. Mr. Jones asked you why  
10 did you write this paper. Right?

11 A Yes.

12 Q And your response was what? I've got it on the screen too  
13 if that helps, but if you want to look at the hard copy, go  
14 right ahead.

15 A It says, "We view the role of an expert as helping other  
16 members of the judicial process make informed decisions. This  
17 requires communicating relevant facts in the case and any  
18 background subject matter that is available to the expert. How  
19 this is best done is an open and important question."

20 Q All right. If we go to the next page, Ms. Miller. And we  
21 look at this paragraph right here. Mr. Jones asked you, "Do  
22 you feel that LR," LR is likelihood ratio, right?

23 A Yes.

24 Q "Should not be used in courtroom testimony?" And what was  
25 your answer?

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1 A "No, that is not our view."

2 Q So let me interrupt you right there. So your view is  
3 likelihood ratios can be used in courtroom testimony, not must  
4 but can be, is that right?

5 A In some cases that may be the -- yes.

6 Q Yes. So it's not forbidden in all instances.

7 A It is not forbidden in all instances.

8 Q That's because he asked you, "Do you feel likelihood ratios  
9 should not be used," and you said, "No, that is not our view."  
10 I'm going to let you finish the answer. I just kind of want to  
11 start with that sentence. Okay. I apologize. "We agreed  
12 there might be instances in which likelihood ratios could be  
13 used in courtroom testimony." Right?

14 A Yes.

15 Q All right. Now, would you please continue with the answer  
16 there.

17 A Okay. "While we did not consider it proven that likelihood  
18 ratios are the final answer, and recognize their limitations,  
19 they may be the best communication strategy currently available  
20 in many forensic applications if one accepts the idea that the  
21 role of the expert is to effectively summarize the relevant  
22 information in the form of a weight of evidence."

23 Q Okay. So far you've acknowledged that you haven't studied  
24 STRmix; you're not an expert in probabilistic genotyping; you  
25 haven't analyzed STRmix as a model to determine how it works or

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1 whether it functions properly. Would you agree with me that  
2 based on those acknowledgments, which are candid in my view,  
3 and your statement here, that it may be the case that  
4 likelihood ratios could be the best communication strategy  
5 currently available to communicate the results of that model?

6 A Yes.

7 Q Now, there's this "if" clause here. I want to talk to you  
8 about this "if" clause. And the "if" clause again is, "If one  
9 accepts the idea that the role of the expert is to effectively  
10 summarize the relevant information in the form of a weight of  
11 evidence." I've read that "if" clause probably a hundred times  
12 in preparing for the hearing today. And I'll admit I struggled  
13 with it. Would you explain to the Court what you mean by that  
14 if clause?

15 A Yeah. So I think as a community we look to forensic  
16 experts, or turn to them to provide valuable information in  
17 reaching a decision. Because of their training and experience,  
18 they have access to data that we don't have information to or  
19 don't have access to. And so a question becomes is the role of  
20 the expert to provide access to what that information available  
21 to them is so that a recipient of that information can better  
22 understand the particular output occurring in a given case, or  
23 is the role of the expert is to characterize what that  
24 information means, their view on what it means.

25 Q Okay. So if there is, if the idea is the job of the expert

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1 is to communicate what they can figure out based on their  
2 training and experience, the tools available to them and the  
3 information provided to them in a particular case?

4 A Are they asked to provide their personal interpretation of  
5 the information, or is their role to provide the information  
6 itself.

7 Q Okay. So I think that goes to actually something Ms. Kloet  
8 asked you about where you said something to the effect of after  
9 three years you have yet to see a likelihood ratio that was  
10 presented in that way, is that right? Is that what you  
11 testified to or do I have that wrong?

12 A Where you say in that way, meaning -- in what do you mean  
13 by in that way?

14 Q Well, a likelihood ratio properly explained to the jury in  
15 the way that you accept that it could be here.

16 A So the request in the article is that if an LR is provided,  
17 the range of plausible other interpretations is articulated and  
18 explored in some thorough manner. And what I'm saying is in  
19 those three years I have not been given an example of a report  
20 or a transcript of testimony that goes through a or that  
21 includes a careful examination of the influence of the various  
22 assumptions used in constructing a model to arrive at a  
23 probabilistic interpretation.

24 Q So you haven't been given that information. Have you  
25 sought it out? Have you looked at transcripts where likelihood

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1 ratios have been presented in court?

2 A No.

3 Q Have you attended criminal trials where likelihood ratios  
4 have been presented to juries?

5 A No.

6 Q So there is no reason to think that you would have seen how  
7 likelihood ratios are actually presented in court during that  
8 time period, is that right?

9 A My expectation would have been that an easy way to settle  
10 the conversation as opposed to having back and forth in the  
11 published literature would have been to say, you know, we think  
12 we understand what you're requesting, and we believe we are  
13 already doing that. Here is an example of where we have  
14 examined the influence on the offered result due to various  
15 factors. Does this seem like what you're asking for? Can't we  
16 say we are already doing this? But I have not received any  
17 correspondence to that effect.

18 Q And is it possible that the reason why is because the  
19 people who have published these academic articles are people  
20 who work at NIST, people who work in the development of  
21 forensic science, and they spend their day working on math  
22 problems and not combing through transcripts of hundreds or  
23 thousands of criminal trials?

24 A So the audience includes the authors of this rebuttal  
25 paper, so Simone Gittelsohn worked at NIST for a few years but

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1 also I believe been employed as a forensic scientist. I know  
2 of John, Dr. Buckleton, worked at NIST for two years or more,  
3 and certainly he is a renowned expert witness appearing in  
4 trials.

5 I believe Kristof Champeau (phonetic) is actively  
6 involved in testimony. So I feel like the community --

7 BY MR. PRESANT:

8 Q Someone should look at the transcripts basically is what  
9 you're saying?

10 A I think, I think the community that authored that list has  
11 direct knowledge of the contents of those transcripts and the  
12 manner in which reports are provided.

13 Q But you haven't looked at them yet.

14 A But I have not looked.

15 Q Let's move on. Let's pull up Government Exhibit 15,  
16 please. Ms. Kloet showed you I think it was Exhibit Q. I'm  
17 just going to use 15 because that way Ms. Miller can move  
18 through the document. It's easier for us. But 15 is also this  
19 paper that you coauthored with Dr. Iyer, "Likelihood Ratio As  
20 Weight of Forensic Evidence: A Closer Look," correct?

21 A Yes.

22 Q So before we get into the line by line of this paper, I  
23 want to talk about a few of the big picture ideas that  
24 Ms. Kloet asked you about as well. In the first one is this  
25 you use the word personal or personalized a lot in the paper,

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1 right? And the Court asked you questions about subjective  
2 decision making too, right? Are those ideas somewhat  
3 equivalent, personalized and subjectiveness of the likelihood  
4 ratio?

5 A I think, yes.

6 Q So you understand that generally in DNA analysis, right,  
7 there's the collection of the sample, and then there's the  
8 building of the model that's used, and then the forensic  
9 scientist him or herself actually uses that model in a  
10 particular case. We agree on that general framework?

11 A I believe so.

12 Q When you talk about the subjective or personal nature of  
13 the likelihood ratio, you're not just talking about that  
14 forensic scientist at the end of the chain, are you?

15 A No. That could be one component of it.

16 Q It's a woman in this case so I'll refer to the forensic  
17 scientist as she.

18 A Okay.

19 Q She may have had input into the model that was personal to  
20 her, those were decisions she made, correct?

21 A I believe so.

22 Q But when the model was being built by whoever built the  
23 model, those people also made subjective or personal decisions  
24 about how to build the model, right?

25 A I believe so.

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1 Q So your discussion of subjectivity or personalization goes  
2 to all of those decisions, not just the one person who uses it  
3 in the particular case, right?

4 A That's correct.

5 Q Now, another idea in this paper is the idea that there can  
6 be multiple models for the same data and that multiple models  
7 may produce different results on the same data, did I get that  
8 right?

9 A Yes.

10 Q In fact, isn't one of your arguments that you can actually  
11 have infinite number of models on a given data set, right?

12 A There theoretically exist an infinite number of models,  
13 yes.

14 Q Because you could put the number 1 in to some limitation,  
15 you could change that to a 2 and a 3 and 4, you can go all the  
16 way up to infinity, that's just one parameter, so there are an  
17 infinite number of parameters that can be tweaked on a  
18 particular model, right?

19 A I would say yes.

20 Q So then what you propose is I think you call it an  
21 uncertainty pyramid, right?

22 A Yes.

23 Q And the idea of the uncertainty pyramid is what?

24 A So the range of potential results that one may obtain for a  
25 given set of data is dependent on what assumptions one invokes



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1       when modelling that data. The intent of the uncertainty  
2       pyramid was to see how that range changes as different  
3       assumptions are folded into the mix. So that one can start to  
4       understand the influence that the assumptions have had on the,  
5       you know, the characterization of the uncertainty of the  
6       result. So how much is our uncertainty shaped by the  
7       assumptions that we have invoked in analyzing the data. At any  
8       point asking what is the range of results that we obtain if we  
9       make these assumptions.

10      Q     And so of the multiple models that are considered in the  
11      context of that uncertainty pyramid, it's not physically  
12      possible to consider an infinite number of models, right?

13      A     Certainly that's the purpose of statistical sampling in  
14      general is to --

15      Q     You aren't going to live an infinite number of days so you  
16      can't consider an infinite number of models, right?

17      A     Nope.

18      Q     In a finite hearing or finite criminal trial that might  
19      last three days or two weeks, you can't consider an infinite  
20      number of models on a data set, right?

21      A     Infinite, no, not infinite.

22      Q     So what do you have to do to solve that problem?

23      A     So part of the key information is what you have been able  
24      to do. So certainly cannot, nobody can fit infinitely many  
25      models, but one can attempt to study this base by fitting as

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1 many as time allows for. And, you know, there may be some  
2 reasoning for why one thinks that within the space of models  
3 that may exist these two are extreme points in a spectrum, so  
4 maybe you can start to understand the range by trying to find  
5 the two models that are very different from one another,  
6 although, satisfying whatever the criteria for being a  
7 reasonable model offered.

8 Or you might say I could fit five different models,  
9 those are the five that I could fit, there are others I  
10 couldn't fit, here's the range of results that we obtained  
11 among these five. If I fit additional models, you know, that  
12 range could expand. You know, we know the range is at least  
13 this big because we found models that pass this criteria that,  
14 you know, values range from A to B.

15 Q And your proposal is that you could introduce multiple  
16 models and explain the decisions, the theoretical framework  
17 that went into creation of those models so that the factfinder  
18 can then determine which model is best, right?

19 A I would say it's to understand how well the offered  
20 quantity is known. What range of results could it possibly  
21 occupy.

22 Q I appreciate that clarification. So you would then have to  
23 educate the factfinder on the background necessary in order to  
24 understand why certain decisions were made, correct?

25 A Maybe that you would have to educate them on the criteria

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1 for assessing whether or not each of those models is considered  
2 reasonable.

3 Q So if we were reviewing probabilistic genotyping models  
4 like STRmix, we would have to give the factfinder background in  
5 probabilistic genotyping, in the statistical underpinning of  
6 that, the biological and chemical underpinnings of that in  
7 order to assess those different models being presented, right?

8 A I don't know to what detail you have to go into the  
9 composition of each of the models if there can be a general  
10 over-arching criteria saying, you know, there are different,  
11 different ways of representing the behavior of these types of  
12 components, we don't have exact knowledge of any of those so we  
13 looked at a range, but we tested each, you know, combination of  
14 those representations that were considered by comparison with  
15 this body of validation data and we kept only those  
16 combinations that were consistent with that data or met  
17 whatever performance criteria required for the model to be  
18 declared reasonable. And so then among those that passed,  
19 here's the range that we observed.

20 Q Isn't it true that the people who built a particular model  
21 may have already considered alternative models in making their  
22 decisions about how to build their particular model?

23 A Certainly they may have explored that. I can't comment on  
24 that.

25 Q This whole discussion is very theoretical, right?

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 A Okay.

2 Q You agree with me on that?

3 A That somebody who has one model may have considered other  
4 models?

5 Q In determining how to build their model, right?

6 A In building their model, yeah. I don't know what the  
7 determining part. I don't know.

8 Q Okay. Let's look at the paper. Can we go to page 2,  
9 please?

10 A Yes.

11 THE COURT: We are still on Exhibit 15?

12 MR. PRESANT: Yes, Your Honor. Let's look at this  
13 paragraph. I'll bring it up on the screen. So consistent with  
14 your testimony here today, the paper says, "Even career  
15 statisticians cannot objectively identify one model as  
16 authoritatively appropriate." Is that right?

17 THE WITNESS: Yes.

18 BY MR. PRESANT:

19 Q And then you talk about how you developed this framework  
20 that explores a range of likelihood ratios, right?

21 A We describe as opposed to develop. We are not trying to  
22 claim that these are new ideas.

23 Q If I said develop I misspoke. You describe it.

24 A Yep.

25 Q So how can you be confident that your framework is

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 authoritatively appropriately?

2 A I appeal to common sense.

3 Q The same thing that someone who built one model might be  
4 doing, right?

5 A You would have to ask them.

6 Q Can we back out, Ms. Miller? Let's look lower down on this  
7 page.

8 So in this sentence here you're saying, "In the  
9 absence of an uncertainty assessment, likelihood ratios may  
10 still be useful as metrics for differentiating between  
11 competing claims when adequate empirical information is  
12 available to provide some meaning to the quantity offered by  
13 the expert." Did I read that correctly?

14 THE WITNESS: I believe so.

15 BY MR. PRESANT:

16 Q And then you go on to say, "Free of normative claims  
17 requiring the use of likelihood ratios, forensic experts may  
18 openly consider what communication methods are scientifically  
19 valid and most effective for each forensic discipline." Is  
20 that right?

21 A Yes.

22 Q So is that paragraph essentially saying that if there's a  
23 lot of empirical information and in a science such as DNA  
24 analysis where allele frequencies are well studied, and the  
25 chemical laboratory equipment has been validated properly, and

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 people who are experts in those particular disciplines have  
2 determined the best way to communicate those ideas, that that  
3 may be a proper use of likelihood ratios?

4 A So I would not say that is the intended meaning of those  
5 sentences.

6 Q Then would you tell me what the intended meaning is?

7 A Sure. So in the first sentence where it talks about,  
8 "Likelihood ratios may still be useful as metrics for  
9 discriminating (sic)," the idea there is that the value  
10 reported is like a score, so it provides maybe an ordering. As  
11 opposed to the number having a literal meaning. So like the  
12 ratio of two probabilities, you say it's just the result output  
13 by the system. To try to find the meaning of that value rather  
14 than looking at that value alone, you try to understand what  
15 does this system do in cases like the one that we are applying  
16 the system to now but in instances where we knew what the truth  
17 was. And it's, it's not then a, we tell you what the  
18 probability is, we tell you, you know, in case, say you have a  
19 thousand cases like this where, if we are talking about DNA say  
20 where the person of interest is known to be a contributor to  
21 the sample, and a thousand instances where they are known not  
22 to be a contributor to the sample. You have some ground truth  
23 thing. You say applying this system results in this set of a  
24 thousand scores for the instances where they are a known  
25 contributor to the sample, and a thousand, here are the other

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 scores that we have obtained when it's not. Now here's the  
2 score that we have obtained in this particular case. And so  
3 now then you look at how does that compare to the behavior of  
4 the system in each of those instances. From that comparison  
5 you then assess, the audience assesses what does it mean. So  
6 like if you say I've done a thousand comparisons where the  
7 person of interest is not a contributor to a mixture, and this  
8 system that was applied for the case never produced a result  
9 bigger than ten, say. And in this instance we saw a value of a  
10 thousand. And if we look at the behavior of the scores when  
11 the person is a contributor to the mixture, we tended to see  
12 scores that ranged from, you know, a hundred to a million. So  
13 the thousand is well within that range.

14 You know, it's that behavior then that informs the  
15 meaning of the value for the audience. So it's being  
16 represented as opposed to an interpretation, it's just a  
17 statement of what are the outputs of the system. That is what  
18 is meant by the first, by the first sentence.

19 Q That's the adequate empirical information.

20 A Yeah, that context of, you know, how has this system  
21 behaved in applications like the one at hand where ground truth  
22 is known.

23 Q The model has to be appropriately validated or studied  
24 before it can be used.

25 A So there's I would say there is a difference. So in

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 validation typically somebody would say because we have  
2 collected a sufficient body of information now we are justified  
3 in offering this precise interpretation of the, of the value.  
4 Whereas in the other one, there's not an exact meaning to it;  
5 it's coming, the meaning comes from, you know, the data  
6 displayed for the behavior of the system. And those are two  
7 different, those are two different things. In one I'm trying  
8 to give you a precise characterization of my personal  
9 interpretation of the meaning of what the data is, and in the  
10 other one I'm trying to give you a thorough insight as to what  
11 the behavior of the system is which would be the basis of my  
12 interpretation to facilitate you understanding that and  
13 arriving at your own interpretation.

14 Q Let's go to page 6, please.

15 A Okay.

16 Q Ms. Miller, if we can have this paragraph under 1.1 list of  
17 concerns. You wrote, "If it can be argued that LRExpert is  
18 sufficiently close to LRDM, then such a substitution may be  
19 acceptable to the DM and fit for his or her purpose." Is that  
20 right?

21 A Yes.

22 Q So the LRExpert is the likelihood ratio specific to the  
23 expert based on the work the expert has done, right?

24 A Yeah. The interpretation of an expert, yep.

25 Q And the likelihood ratio DM, DM stands for decision maker,



## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 right?

2 A Yes.

3 Q That would be the jury or the judge depending on who is the  
4 decision maker, right?

5 A Yes.

6 Q You acknowledge here there are instances where it may be  
7 that the likelihood ratio expert is sufficiently -- where the  
8 expert is sufficiently close to the likelihood ratio for the  
9 decision maker, right?

10 A Certainly. If the range of plausible interpretations from  
11 study of different perspectives of it is very narrow, that may  
12 give confidence to the community that any reasonable  
13 interpretation is sufficiently similar and now we are in,  
14 everybody would be happy; there is no dispute that a different  
15 reasonable interpretation would substantially differ.

16 Q All right. Let's go to page 9. One of the examples you  
17 use in this paper is studying the refractive indices of glass  
18 windows, right?

19 A Yeah. It uses just a publicly available data set for an  
20 illustrative example.

21 Q And one thing you say is that in order to have a high  
22 degree of confidence in studying these glass windows, you would  
23 need, right, this is the confidence part that I just underlined  
24 you would need, "refractive index data from many windows with  
25 enough measurements from each window so as to convince oneself

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 that strictly limiting the set of plausible distributions to a  
2 location family will have only a negligible effect on the  
3 interpretation of the analysis." Right?

4 A Yeah. So the idea there is that a common implementation  
5 for a probability model is to say, you know, maybe the behavior  
6 for each window is not exactly the same. But maybe we will say  
7 it follows the same distribution with the same spread except  
8 the center shifts around. That sentence speaks to what would  
9 the empirical basis be in order to provide confidence that  
10 really the distribution of refractive indices in glass has or  
11 satisfies that constraint.

12 Q To have confidence in the model you need a lot of data.

13 A To justify the sole consideration of that assumption you  
14 would need a lot of data to say any other reasonable assumption  
15 is going to be sufficiently similar to the results produced by  
16 this.

17 Q And you're not an expert in DNA analysis but it may be the  
18 case that DNA is a field in which there is lots of empirical  
19 data that would give you confidence in the assumptions that  
20 could go into models, right?

21 A I think there could be lots of data, and I don't know what  
22 the range of reasonable interpretations given that data is for  
23 any particular case. I have not studied that.

24 Q Right. But your point is more data is better.

25 A No. My point is whatever data you have there's a range of

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 reasonable interpretations and you don't know what that range  
2 is until you've studied it from different perspectives.

3 Q You need to have studied it carefully.

4 A From multiple perspectives, yes.

5 Q I'm attempting to frame my questions to elicit yes or no  
6 answers. But it's your testimony. I'm trying to simplify  
7 here. That's all I'm trying to do.

8 Let's go to page 10. Right there, Ms. Miller. Page  
9 10 you're talking about multiple plausible models and you  
10 write, "It is possible for the criteria of a specific  
11 individual to be expressed in an objective manner." Is that  
12 right?

13 A Yes.

14 Q Page 20, please. Let's look at this bottom area. So this  
15 is the one part of this paper that actually refers to DNA,  
16 right?

17 A Yes.

18 Q And again, it's not because you studied DNA but this is  
19 part of the discussion where you're talking about different  
20 application of these ideas, right?

21 A Yeah.

22 Q And one thing you wrote here is, "One might expect to find  
23 the least degree of uncertainty in applications of  
24 probabilistic evaluation of high-template, low-contributor DNA  
25 samples, and we recognize that the community may be well

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 founded in its use of probability to facilitate knowledge  
2 transfer in such cases." Did I read that correctly?

3 A Yes.

4 Q You stand by that, that forensic DNA analysis might be an  
5 area where there's less uncertainty than in other forensic  
6 disciplines because again your paper just is sort of general to  
7 forensic science, right?

8 A Yes. Am I allowed to read the next sentence or is that  
9 not --

10 Q If you would like to, sure.

11 A Okay. So the following sentence to that quote it says, "We  
12 do not view this as an exception to the framework we present,  
13 but rather as a scenario in which extensive uncertainty  
14 evaluations would likely yield a degree of consensus leading  
15 most people to conclude an offered LR value is fit for the  
16 intended purpose." So the intent there was that the best case  
17 scenarios with DNA, there may not be a whole lot of modelling  
18 variability so if one were to go examine, they may find that  
19 the range is sufficiently narrow as to warrant its use. But --

20 Q You would have to go examine in order to do that, right?

21 A Yes, so we would have to study what the different  
22 perspectives are for a given application or a given  
23 electropherogram.

24 Q Lower down in the same block you wrote, "When an LR value  
25 is the output of a computer algorithm, one may reasonably

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 assume that, given the inputs, it is highly reproducible."

2 Correct?

3 A Yes.

4 Q There are multiple ways to calculate an LR, and every time  
5 you get an LR it doesn't mean someone got there using a  
6 computer algorithm to do it, right?

7 A So that there are ways to arrive at an LR other than using  
8 a computer algorithm?

9 Q Right.

10 A Yes. Yes.

11 Q And if I read the sentence correctly, what you're saying is  
12 use of computer algorithm is preferable because it's highly  
13 reproducible.

14 A Yeah, the output, the output of a fixed body of computer  
15 code to fixed inputs we expect to be very stable.

16 Q Page 22, please. My last question actually looking at the  
17 paper itself. The end of your paper you talk about the scoring  
18 method, right?

19 A Yes.

20 Q And if I understand it correctly, you're saying, well, in  
21 some instances it might be better to use a scoring method which  
22 would still be a number, is that right?

23 A An ordering. Sometimes people use, for instance, the  
24 identification inconclusive, exclusion paradigm could also be  
25 seen as an ordering in that the strength of evidence is highest

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 for an identification articulation and exclusion is the lowest.  
2 So that still is ordering. That's not numeric. But I think it  
3 suffices to consider scoring method as a numeric output.

4 Q What about a verbal equivalency table where LRs were  
5 converted to verbal equivalent, would that be an example of a  
6 scoring method?

7 A If one looks at it just as the ordering, yes.

8 Q That's all I have for 15. You can take it down. All  
9 right. I would ask you to look at Exhibit MM which Ms. Kloet  
10 introduced. It's the paper you said you received by e-mail a  
11 day or two ago.

12 A Yep. Yep.

13 Q Government received by e-mail just last evening. The paper  
14 was very new to all of us.

15 A I don't know if it was Tuesday evening after my flight,  
16 after my flight had landed and I got to the hotel and checked  
17 my e-mail it was in my inbox. I don't remember the exact time  
18 at which it was sent.

19 Q Let's look at page 158, figure 1. In figure 1 do you know  
20 if that first indication of drop-in and 14 has been described  
21 accurately?

22 A No.

23 Q What about the drop-out at 16.3 to the right, do you have  
24 an opinion on that?

25 A I do not.

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 Q Do you know what's being described in figure 1, the  
2 54 percent and the 100 percent and 48 percent?

3 A So not at this moment, no.

4 Q You haven't reviewed it carefully enough yet in order to  
5 have an opinion on that.

6 A Correct.

7 Q That's fine. You don't need to take the time now.

8 Let's go to page 161 Ms. Kloet asked you about. And  
9 Ms. Kloet asked you about this table 1 at the bottom, right?

10 A Yes.

11 Q The bottom, correct, not bottom right, just at the bottom.

12 A Yes. Yes.

13 MS. KLOET: Sorry to interrupt but just to make the  
14 record clear I think the Court was inquiring about that table.

15 THE COURT: Yes.

16 MR. PRESANT: Someone asked you questions about the  
17 table, right?

18 THE WITNESS: Yes.

19 BY MR. PRESANT:

20 Q I actually want to look at the title of the table. What is  
21 the title to the table?

22 A Table 1, you mean the caption?

23 Q Sure, the caption.

24 A Hypothesis and LR values obtained by each of the  
25 participating laboratories. All laboratories used the

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 LRmixStudio software, except those marked as with the single  
2 asterisk, which implies used EuroForMix or a double asterisk  
3 used DNAMIX. And then goes on to --

4 Q You don't have to read the legend. So I believe the point  
5 Ms. Kloet was trying to make is that these numbers here have a  
6 large variation, likelihood ratio, right?

7 A I believe that's her point. I may have to ask her.

8 Q And they do in fact have a large range of variation, right?

9 A I would characterize that as substantial, yes. To me.

10 Q That's fine. It's your testimony. If you want to say it's  
11 substantial --

12 A Okay.

13 Q And these varying values came from it looks like three  
14 different models. I'm not sure why they are all on the same  
15 table then, but the three models being LRmixStudio, EuroForMix,  
16 and DNAMIX. Right?

17 THE COURT: Well, but there's only one of the  
18 EuroForMix and one of the DNAMIX, all the rest are of the  
19 LRmixStudio software.

20 MR. PRESANT: You're correct, Your Honor. I  
21 appreciate that clarification. So mostly from one model or  
22 piece of software but a couple of the data points are from  
23 different pieces of software, right?

24 THE WITNESS: Yeah. I believe when I said a range, I  
25 restricted only to the subset of those indicating they were



## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 analyzed using LRMixStudio.

2 BY MR. PRESANT:

3 Q I'm pointing it out but it's actually not important for my  
4 question. My question for you, first question for you is are  
5 any of those three software models STRmix?

6 A No.

7 Q Does the range of outputs of the model differ based on the  
8 model itself?

9 A It could.

10 Q If I told you that there's been testimony that the range of  
11 outputs for STRmix is within one order of magnitude, would that  
12 surprise you?

13 A Would it surprise me that that's the testimony?

14 Q That model could produce a range of outputs that only  
15 varied typically by one order of magnitude.

16 A It depends over what input factors are allowed to vary. It  
17 would not surprise me that some components of a model free to  
18 vary leads to an order of magnitude difference. I don't know  
19 what all factors are included in that variation.

20 Q And in here in this table 1 the range of orders of  
21 magnitude is much greater than that, it's I think 12 orders of  
22 magnitude, is that right?

23 A 11 if we restrict to the application of the same software.  
24 Because the lowest one was EuroForMix. So it's the second one  
25 which has a 10 to the 3.

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 Q You're absolutely right. Do you know who developed these  
2 software programs?

3 A No.

4 Q Do you know when they were developed?

5 A No.

6 Q If I told you that at least a couple of them were developed  
7 in the 1990s, would you have any reason to dispute that?

8 A No.

9 Q Do you know why there would be a paper published in 2018  
10 studying software models from the 1990s?

11 A I don't know what the motivation of the authors are.  
12 Perhaps those are the ones that are utilized in case work in  
13 their countries. You would have to ask them.

14 Q Let's go to page 159, please. Can we look at this  
15 paragraph in the paper? The authors here wrote, starting this  
16 sentence, "In this sense, following the recommendations of the  
17 ISFG, a large majority of participants employed the likelihood  
18 ratio statistic as the most appropriate approach for  
19 statistical evaluation for the autosomal mixture profile." Did  
20 I read that correctly?

21 A I believe so.

22 Q Now, you filed or rather your attorney in this case filed a  
23 declaration just on Monday, is that right?

24 A I believe so.

25 Q You signed a declaration?

## STEVEN LUND - CROSS EXAMINATION - MR. PRESANT

1 A I did.

2 Q In that declaration you wrote, "The article does not  
3 include," the article referring to the article you and Dr. Iyer  
4 wrote.

5 A Yes.

6 Q Correct? You say, "The article does not include any  
7 empirical research by my coauthor or myself intended to  
8 validate or invalidate a specific probability model including  
9 models used by the STRmix software, or other probabilistic  
10 genotyping models. I have never conducted empirical research  
11 on the reliability of DNA analyses including the reliability of  
12 STRmix software."

13 A That's correct.

14 Q Did I read that correctly?

15 A Yes.

16 Q Do you stand by that statement as you sit here today?

17 A Yes. I have never conducted empirical research into  
18 probabilistic genotyping.

19 Q Lower down you wrote, "I am unaware of any empirical  
20 studies conducted by other researches at NIST on the  
21 reliability of probabilistic genotyping for the STRmix software  
22 in particular." Do you stand by that statement as you sit here  
23 today?

24 A Yes, I do.

25 Q And the last paragraph, "I do not know any specific studies

## STEVEN LUND - REDIRECT EXAMINATION - MS. KLOET

1 that have either validated or invalidated results derived from  
2 STRmix software or compared the results of STRmix software  
3 probability assessments with the assessments of other plausible  
4 models." Do you stand by that statement as you sit here today?

5 A I do.

6 Q My last set of questions for you, Dr. Lund, actually do  
7 relate to that paper again but we are not going to look at that  
8 paper. Is one way of viewing your argument really  
9 philosophical in terms of the method by which a witness  
10 communicates to a jury?

11 A Philosophical in what sense?

12 Q The jury's ability to understand the information that the  
13 expert is attempting to convey.

14 A Yeah. Certainly it's with regard to what expectations the  
15 decision maker or the third party, the receiver of the  
16 information comes to expect to exist on the basis of what's  
17 said.

18 Q But ultimately that's not a scientific question, correct,  
19 that's a legal determination for the Court about the order and  
20 mode of the presentation of witnesses and evidence to a jury,  
21 right?

22 A I think certainly there are legal considerations to that.  
23 I would say that existence of measurement science is largely in  
24 part to or is largely to facilitate calibrated communication  
25 among individuals so that we can accurately understand what is

## STEVEN LUND - REDIRECT EXAMINATION - MS. KLOET

1 said by one party.

2 Q It's helpful for a Court to consider science but ultimately  
3 the way that evidence is presented is a legal determination for  
4 the Court, you would agree with that?

5 A Certainly. I have no authority to say what's permitted or  
6 what's not.

7 Q As we have discussed, it may be the case with certain areas  
8 of forensic science where if models are properly developed and  
9 studies that likelihood ratios may be the best method of  
10 communicating scientific evidence to a jury.

11 A Yeah, depending on what the meaning of best is.

12 MR. PRESANT: Nothing further, Your Honor.

13 THE COURT: Any redirect?

14 MS. KLOET: Just a couple, Your Honor.

15 REDIRECT EXAMINATION

16 BY MS. KLOET:

17 Q Could you open your defense binder to Exhibit P, please?  
18 The last page. P as in Peter.

19 A Thank you.

20 Q So I'm showing you the written record of the interview that  
21 you and Dr. Iyer had with John Paul Jones of NIST. And I just  
22 wanted you to pay attention or call your attention to a couple  
23 sentences here. If you can look in the very first paragraph,  
24 not the complete paragraph but the first paragraph. Could you  
25 read that final sentence for me, please?

## STEVEN LUND - REDIRECT EXAMINATION - MS. KLOET

1 A The thing that begins with of course?

2 Q No. Right before that it starts with it seems.

3 A You said this is on the --

4 Q Very top, it's the second --

5 A This is on the second.

6 Q On the back page. I'm sorry.

7 A I'm sorry, the last sentence on that first bulk of body of  
8 text. "It seems reasonable to think that LR, or likelihood  
9 ratio, are an improvement over the older paradigm, but it is  
10 premature to think of likelihood ratios as the final answer for  
11 all forensic disciplines."

12 Q And do you stand by that statement today, do you agree with  
13 it?

14 A That represents my perspective, yes.

15 Q Does it also represent Dr. Iyer's?

16 A I believe so, yes.

17 Q If you can go to the final full paragraph. The heading on  
18 that paragraph is, "Then what was the point of "urging caution"  
19 when using likelihood ratio, as the NIST press release  
20 mentions?" Can you read the sentence that starts with "in  
21 particular" and just complete the paragraph, please? It's  
22 about halfway through the paragraph.

23 A "In particular, experts should counteract potentially  
24 unwarranted reverence jurors may place on provided LR due to  
25 the mathematical machinery that often underlies LR

## STEVEN LUND - REDIRECT EXAMINATION - MS. KLOET

1 computations. Additionally, we feel that there are  
2 descriptive, rather than interpretive, means of communicating  
3 evidence that have not been fully pursued due to the current  
4 focuses on likelihood ratio development."

5 Q As you sit here today, do you agree with that statement?

6 A Yes, I do.

7 MS. KLOET: Nothing further, Your Honor. Thank you.

8 THE COURT: Any recross, Mr. Presant?

9 MR. PRESANT: No, Your Honor.

10 THE COURT: Thank you, Dr. Lund. You may step down.  
11 It's about 11:30 so let's, let me ask this. You have one more  
12 witness, Ms. Kloet?

13 MS. KLOET: That's correct, Your Honor.

14 THE COURT: Okay. It's 11:30. Let's take our lunch  
15 break now and come back at 12:15 ready to hear the defense  
16 final witness.

17 THE WITNESS: Thank you, Your Honor.

18 THE LAW CLERK: Court is in recess.

19 (Recess taken, 11:32 a.m.; Resume Proceedings,  
20 12:31 p.m.)

21 THE LAW CLERK: All rise. Court is back in session.  
22 Please be seated.

23 THE COURT: Ms. Kloet.

24 MS. KLOET: Your Honor, the defense calls Nathan  
25 Adams.

## NATHAN ADAMS - DIRECT EXAMINATION - MS. KLOET

1 THE COURT: I'm sorry.

2 MS. KLOET: The defense calls Nathan Adams. Would you  
3 like me to address the housekeeping issue quickly with respect  
4 to exhibits?

5 THE COURT: I'm sorry?

6 MS. KLOET: I would like to address a housekeeping  
7 issue quickly with respect to exhibits. Defense Exhibit Q  
8 which is the same as the Government's Exhibit 15 I don't think  
9 was ever formally admitted. I would like to -- I didn't  
10 previously move to admit that as Lund/Iyer's article. I would  
11 like to do so now.

12 THE COURT: Mr. Present.

13 MR. PRESENT: Well, the government did mark 15. It  
14 intentionally did not offer 15, but I don't have a basis for  
15 objecting to Q.

16 THE COURT: It's admitted.

17 MS. KLOET: Thank you. If the Court is prepared the  
18 defense calls Nathan Adams as its final witness.

19 NATHAN ADAMS, DEFENSE WITNESS, WAS DULY SWORN

20 THE LAW CLERK: Please be seated. And state your full  
21 name for the record, spell any unusual spellings.

22 THE WITNESS: My full name is Nathaniel, I-E-L, David  
23 Adams.

24

25



## NATHAN ADAMS - DIRECT EXAMINATION - MS. KLOET

## DIRECT EXAMINATION

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BY MS. KLOET:

Q Mr. Adams, could you describe your formal education, please?

A I have a bachelor's of science in computer science from Wright State University, and I'm currently working on master's of science in computer science.

Q And where are you working on that master's program?

A Also at Wright State.

Q Where is Wright State University?

A Outside of Dayton, Ohio.

Q While you were in your graduate program, was there a specialization you did there?

A Yeah. I focused on bioinformatics.

Q Did that specialization require additional course work beyond what was required for a standard computer science bachelor of science degree?

A It did.

Q What were some of those courses?

A They were biology or biology courses in genetics, and specifically in bioinformatics as in the course title.

Q Have you taken any courses in mathematics or in statistics?

A Yes, I have.

Q What are those courses?

A Between math and statistics, I have taken, in addition to

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1 my high school math, trig and the like, I've taken college  
2 level calculus, linear algebra, discrete mathematics,  
3 statistics for engineers, and then a number of my courses have  
4 heavily focused on different mathematical concepts.

5 Q Did you take any courses in college or post graduate where  
6 you did any sort of data analysis as part of that course?

7 THE COURT: One second, please.

8 BY MS. KLOET:

9 Q My question was whether you took any courses during your  
10 college years or post graduate college years where you engaged  
11 in any data analysis as part of those course requirements?

12 A Yes, I took a number of courses that involve data analysis.

13 Q Did you take any courses in data mining during that time?

14 A Yes, I took courses with that specific title.

15 Q Please tell me about the experience you have if any with  
16 the intersection between computer science and biology or DNA  
17 principles.

18 A From my undergraduate experience I took a number of courses  
19 that studied either biology systems, chemical systems, or  
20 computer science topics. I took a number of courses that  
21 explicitly combined those using computer analytical tools to  
22 solve questions or address questions in biology. And in a  
23 number of additional courses I chose that as a project data set  
24 to explore data analysis within biology, well, on biology data.  
25 I was involved in --

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1 Q Can I interrupt you for a second? You said you chose that  
2 as a data set. What did you mean by that?

3 A There's a large quantity of freely available biology data  
4 sets that can be downloaded. So when there are specific models  
5 or methods that we were learning in a classroom setting, it was  
6 often left to the students devices to choose an appropriate  
7 data set and perhaps even an answer, a question and answer to  
8 develop a model for that specific data set. So I would  
9 download DNA sequence data, protein sequence data, protein  
10 structure data, stuff like that.

11 Q While you were in your undergraduate program, were you a  
12 member of any associations?

13 A I was a member of a research group, the Bioinformatics  
14 Research Group.

15 Q Is that part of a department?

16 A It's run by computer science professor at Wright State.

17 Q Were you a student member of any larger organization?

18 A I was a student member for a time of two professional and  
19 scientific computing organizations.

20 Q What are those?

21 A One is IEEE, that's the Institute of Electrical and  
22 Electronic Engineers and the ACM which is the Association for  
23 Computing Machinery.

24 Q What types of projects were you involved in at the first  
25 one you listed, the Bioinformatics Research Group?

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1 A We would alternate taking up projects. Most of the members  
2 of the group had computing backgrounds, some had biology, study  
3 biology sciences as well. On one particular project that I  
4 worked on was about molecular evolution studying genes that had  
5 been identified in a number of different species comparing and  
6 contrasting the differences of those genes to identify patterns  
7 of interest.

8 Q You mentioned you're enrolled in your master's program now.  
9 Where are you in that program?

10 A I have completed the required course work, required number  
11 of credits for course work, but I have, I have to submit and  
12 then defend my thesis.

13 Q What is your thesis? Have you chosen a topic?

14 A Yeah, the topic, the data set and computational problems  
15 that I'm working are related to the number of, estimating the  
16 number of contributors in a mixture.

17 Q In a mixture of what?

18 A Forensic DNA mixture.

19 Q What will your master's degree be in specifically if you  
20 graduate?

21 A The field would be computer science.

22 Q What type of research and/or studies have you done  
23 throughout the course of your master's program at Wright State  
24 for your thesis? I'm sorry. So narrow it to your thesis.

25 A For the thesis is again there's freely available data sets

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1 online that anybody can download and utilize. And I have  
2 developed tools to simulate mixtures, mixed DNA samples  
3 following methods that were originally published a little over  
4 ten years ago, and in an attempt to apply those methods and  
5 techniques to a novel data set while also addressing  
6 computational, addressing the issue from a computational  
7 perspective.

8 Q Do you have a master's advisor?

9 A I have two advisors.

10 Q Who are those advisors?

11 A There's a computer science and engineering professor, Dr.  
12 Travis Doom, D-O-O-M, and professor of biology sciences, Dr.  
13 Dan Krane, K-R-A-N-E.

14 Q Are you currently employed?

15 A I am.

16 Q Where are you employed?

17 A Forensic Bioinformatics Services.

18 Q What is your position there?

19 A My title is a systems engineer.

20 Q What is Forensic Bioinformatics in the business of?

21 A We provide consulting services about forensic DNA, forensic  
22 biology testing that's been conducted. We will review  
23 materials generated during testing and analysis and consult  
24 with almost exclusively lawyers.

25 Q Who else works at Bioinformatics with you as a full-time

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1 employee?

2 A I'm one of two full-time employees. The other is a  
3 biologist, our analyst, Carrie Rowland.

4 Q Are there part-time employees?

5 A We have several part-time employees.

6 Q What do they specialize in, just quickly?

7 A We have a bookkeeper, part-time bookkeeper, we have a  
8 separate part-time accounts manager who works with invoicing  
9 and the like. We have currently working there two interns, one  
10 is a biomedical engineer, and the other intern is a former  
11 forensic scientist whose gone back to school for computer  
12 science.

13 Q Does Dr. Krane work at Forensic Bioinformatics?

14 A He does. He's the president.

15 Q Does Forensic Bioinformatics have any outside consultants  
16 with whom it works or with whom you work more specifically?

17 A We have a number of colleagues who we collaborate with,  
18 some more than others. There's several principals to our  
19 organization, and then there's a number of long time colleagues  
20 of my boss and now myself I would like to think.

21 Q What are their areas of expertise?

22 A There's a wide variety. Depending on what particular issue  
23 we're addressing, we will call on the services of different  
24 folks. We have the principals of the company, there's I  
25 believe four, four professors, so one biologist, two computer

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1 science and engineering professors, one who is, I always  
2 butcher this, a psychology, criminology and law I believe is  
3 his title. And we have a more business affiliated partial  
4 owner, part owner. And another forensic DNA consulting  
5 scientist.

6 Q How long have you worked there?

7 A Five years now.

8 Q Can you describe briefly but thoroughly your duties in that  
9 position, your daily duties in that position or normal duties  
10 in that position.

11 A My duties are evolving, but they generally deal with  
12 requesting and receiving materials generated during the course  
13 of DNA analysis, a forensic DNA analysis, effectively the case  
14 file or the bench notes of what the laboratory might have  
15 generated.

16 Q Do you review those materials that you receive?

17 A I do.

18 Q Go on.

19 A I'm one of the, well, I will typically review the  
20 electronic data that was generated during the course of  
21 testing, the output of the genetic analyzer, which is the basis  
22 of the electropherograms that have been discussed. There's a  
23 sequence to our reviews as there is a sequence to the DNA  
24 testing. So once we have reanalyzed the electronic data  
25 there's often questions about interpretation, evaluation of

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1 standard operating procedures, protocols, comparison of what  
2 was done in this case, compared to both what's done in  
3 generally in the field, or more specifically, what this lab  
4 says they're supposed to do in their protocols. So there's a  
5 range of duties depending on what's needed in a particular  
6 case. But we also spend a fair bit of time doing education  
7 outreach, giving talks, lectures, participating in  
8 conversations. And when there's time and an issue, try to  
9 publish a paper.

10 Q Do you review the literature in the fields that touch upon  
11 your work at Forensic Bioinformatics?

12 A Yes. That's part of my regular duty.

13 Q You try to keep current on that.

14 A I do.

15 Q Do you ever review a validation study in the course of your  
16 employment there?

17 A Yes.

18 Q How about software systems themselves of any nature, do you  
19 ever do that?

20 A Yes, I review software.

21 Q Okay. In that position do you only review cases that deal  
22 with forensic biology?

23 A My company specializes in forensic biology. So there's  
24 forensic DNA and serology are typically the two components to  
25 that.



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1 Q How many electropherograms do you think you've reviewed in  
2 the course of your career?

3 A Too many to count. Thousands.

4 Q How many biology laboratory's protocols or procedures do  
5 you think you've reviewed, just approximately?

6 A Likely dozens.

7 Q What has been your experience or extent of your experience  
8 with Probabilistic Genotyping Systems in the course of your  
9 employment?

10 A So now for, for most of the time that I've been, we call  
11 our company FBS, so if I make reference that's what I'm  
12 referring to, spent, it's an increasing part of my focus at FBS  
13 and goes back to shortly after I joined the company. There was  
14 an increasing conversation about probabilistic genotyping just  
15 in the general forensic DNA community. That caught my  
16 attention and in 2014 I attended a workshop which is kind of  
17 the milestone in my mind of when my attention really turned  
18 towards probabilistic genotyping.

19 Q What was that workshop about?

20 A It was introducing Probabilistic Genotyping Systems to  
21 forensic DNA analysts. It was put on by the Midwest  
22 Association of Forensic Scientists in St. Louis.

23 Q That was 2014?

24 A Yes.

25 Q Currently would you say you work on or with Probabilistic

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1 Genotyping Systems or programs on a daily basis?

2 A Yeah. If not the systems themselves, then certainly the  
3 data and conclusions outputted by them.

4 Q And you've given testimony before on cases involving the  
5 use of Probabilistic Genotyping Systems, have you?

6 A I have.

7 Q Do you know how many times approximately?

8 A Six or seven.

9 Q Have you written reports or declarations in cases involving  
10 this type of material?

11 A Yes, I have.

12 Q Have you received any other training on Probabilistic  
13 Genotyping Systems?

14 A In addition to the general continuing education, the more  
15 informal stuff like webinars, reading articles, having  
16 conversations; a few months ago I attended the STRmix workshop,  
17 four-day workshop that's been mentioned a couple times.

18 Q When did you attend that?

19 A Several months ago. I believe it was March.

20 Q What was covered, just succinctly covered at that workshop?

21 A There was an overview of the principles of the underlying  
22 forensic DNA models that describe molecular DNA behaviors, how  
23 those fit together in STRmix. Overview of the underlying  
24 sampling algorithm of STRmix, and then a number of hands-on  
25 exercises that increased in complexity from replicating results

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1 in Excel to fully running the software.

2 Q Did you receive any training on the calculation of a  
3 likelihood ratio manually and/or using STRmix?

4 A Yes.

5 Q Were you given or provided with a copy of STRmix to try  
6 yourself during that training?

7 A Yes. Attendees got a trial version.

8 Q Have you personally reviewed STRmix outside of that  
9 workshop that you just mentioned?

10 A Yes.

11 Q When was that?

12 A I reviewed the source code several weeks ago.

13 Q Did you do it any other time?

14 A About two, two and a half years ago.

15 Q Have you reviewed other probabilistic genotyping software  
16 systems?

17 A Yes.

18 Q What are those?

19 A I have reviewed the underlying, the foundational literature  
20 to a number of systems reading the articles that are written  
21 about it, as well as for freely available and open source  
22 versions I've evaluated a number of those to varying degrees  
23 since they are simply available online.

24 Several times I've, my company has been hired to  
25 review the forensic statistical tool, FST, which is a

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1 probabilistic genotyping program that was or still is used by  
2 the New York City office of the chief medical examiner there at  
3 the city's lab, forensic DNA lab.

4 Q How many times have you reviewed FST?

5 A We have been retained to do it three or four times. I  
6 think not all of those have, have been finalized. Not all of  
7 those were finalized.

8 Q How many times did you review that program?

9 A I've spent two or three code reviews, what I would call it.

10 Q Have you ever heard of TrueAllele?

11 A Yes, I have.

12 Q Have you reviewed that?

13 A Not at source code.

14 Q Have you reviewed any materials related to TrueAllele?

15 A Yes, I have.

16 Q Like what?

17 A There's a number of articles that have been published in  
18 the literature about the underlying principles of TrueAllele.  
19 There's laboratories that adopt it including the parent  
20 company, Cyber Genetics have manuals for the use and operation  
21 of TrueAllele. There are validation studies that labs who  
22 bring TrueAllele online have to conduct. So I have reviewed  
23 those. I've reviewed data specific to particular samples and  
24 particular cases, how TrueAllele evaluated those evidentiary  
25 items for reference. I don't know if it's been mentioned but

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1 TrueAllele is one of the chief competitors to STRmix.

2 Q Thank you. In your professional opinion as a computer  
3 scientist, what skills were necessary in order for you to  
4 perform these types of reviews of these various programs?

5 A Well, certainly any time you're reviewing source code it,  
6 you need to understand source code. You need to have a  
7 familiarity with the programming language in which it's  
8 written. And understanding the underlying principles and  
9 certainly the vocabulary of the field of forensic DNA is going  
10 to benefit any review.

11 Understanding how it's used by laboratories, by  
12 analysts is also helpful to understand how the data is intended  
13 to flow through the program, how it's evaluated before and  
14 after it enters and exits the program.

15 Q Do you need to have any familiarity with algorithmic design  
16 such as Markov Chain Monte Carlo?

17 A Well, it would help, yes.

18 Q And do you have any familiarity with that?

19 A Yes, I do.

20 Q Are you familiar with SWGDAM?

21 A I am.

22 Q Have you reviewed their guidelines for validation of  
23 probabilistic genotyping software systems?

24 A Yes, I have.

25 Q Are you a member currently of any professional

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1 organizations?

2 A I am.

3 Q What are those?

4 A The ones that I mentioned earlier, IEEE, and ACM.

5 Q Have you won, during the course of your career or your post  
6 graduate career, have you won any awards or grants?

7 A Yes. As an undergraduate I won -- my senior design team  
8 that was tasked with conceiving and constructing a useful  
9 product, won the engineering school's award, recognition award  
10 which was presented to one team.

11 Q What kind of data did that deal with?

12 A The premise of the project was to add functionality to an  
13 open source. The name of the software is Osiris. It's  
14 developed by the federal government and freely distributed.  
15 It's an open source software program for the evaluation of the  
16 data that comes out of a genetic analyzer, the basis of the  
17 electropherograms. So we added, defined and added  
18 functionality to that software as well as developed a reporting  
19 framework that we felt would be conducive to forensic DNA case  
20 reviews.

21 Q Have you received any other awards or grants?

22 A Yes. Just recently we were -- I'm a member of a team who  
23 was awarded a grant from Columbia.

24 Q What is that grant for?

25 A It's for an investigation and evaluation of Probabilistic

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1 Genotyping Systems, how they evaluate data.

2 Q You said you're a member of a team. How many people are on  
3 that team?

4 A There's six named members and there's likely people who  
5 will help out or perhaps graduate students who become the  
6 recipient of that grant money.

7 Q In what fields are those other six members?

8 A Myself and there's -- so in addition to myself, the other  
9 five members include a professor of computer science, a  
10 professor of biology, a criminal defense lawyer, a journalist,  
11 and a professor of statistics.

12 Q Have you conducted any sort of presentations or seminars in  
13 your professional career?

14 A Yes.

15 Q Have you given any of those presentations or seminars at  
16 NIST?

17 A Yes.

18 Q When was that?

19 A I gave a talk several years ago at I believe the name of  
20 the symposium is the Error Management Symposium at NIST, or put  
21 on by NIST. And I gave a talk that was on the management of  
22 bias in forensic science contexts.

23 Q Do you have any recent publications?

24 A Recently a letter to the editor of the "Journal of Forensic  
25 Sciences" was published.

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1 Q Can you turn, you should have a binder over there that says  
2 defense exhibits to your right. Can you turn to tab E, please?  
3 Is this the document that you just referred to?

4 A Yes.

5 Q What is this? What was the purpose of writing this letter?

6 A To explain the basis for advocating, for advocating the use  
7 of for developing software standards for the field of forensic  
8 DNA and specifically probabilistic genotyping.

9 Q Did you have any coauthors on this letter?

10 A I did.

11 Q Who were they?

12 A Dan Krane mentioned before. Can I read their --

13 Q Sure. If you need to refresh your recollection go right  
14 ahead.

15 A Roger Koppl is a professor of finance and regularly works  
16 on the risks and merits of expertise and bias. Dr. Krane. Dr.  
17 Thompson is one of the principals of Forensic Bioinformatics,  
18 he's the professor of psychology, criminology, and law. I can  
19 find the -- there. It's the Department of Criminology, Law and  
20 Society, and a member of one of NIST's OSAC groups, as well as  
21 Professor Sandy Zabell who is a professor of statistics at  
22 Northwestern and a member of an OSAC group as well.

23 Q What was the position you took, briefly as possible, in  
24 this particular letter?

25 A That there's been, generally there's been an insufficient



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1 or almost total lack of conversation about the merits of  
2 software standards in probabilistic genotyping system  
3 development, and that they are important. It's important to  
4 have those conversations.

5 Q And to what journal did you submit this letter?

6 A The "Journal of Forensic Sciences."

7 Q Was this letter submitted to peer review?

8 A It was.

9 Q Do you know the identity of the peers who authored that  
10 letter?

11 A I do not.

12 Q Reviewed that letter, pardon me.

13 MS. KLOET: Your Honor, I move that Defense Exhibit E  
14 be admitted into evidence.

15 THE COURT: Mr. Presant.

16 MR. PRESANT: Voir dire, please.

17 THE COURT: Sure.

18 MR. PRESANT: Mr. Adams, the letter marked Exhibit E  
19 is your only peer reviewed publication to date, is that right?

20 THE WITNESS: Published, yes.

21 MR. PRESANT: Well, what sort of publications are not  
22 published?

23 THE WITNESS: I stand corrected. The answer is yes.

24 MR. PRESANT: Okay. Thank you. What, the Court has  
25 seen a lot of published articles in the course of this

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1 proceeding; you know, some of those are five pages long, some  
2 of those might be 80 pages long. This looks a little  
3 different. It's a letter to the editor, right?

4 THE WITNESS: Yes, sir.

5 MR. PRESANT: What's the difference between a research  
6 article that is published in a journal and a letter to the  
7 editor?

8 THE WITNESS: Most journals have gradations or  
9 categories of submissions to the journal. So I am familiar  
10 with JFS, this journal, and FSI Genetics have recognition for  
11 original research articles which is the sense of conducting an  
12 experiment, reporting those results.

13 MR. PRESANT: Adding something new to the scientific  
14 community.

15 THE WITNESS: Yes.

16 MR. PRESANT: And what's a letter to the editor by  
17 contrast?

18 THE WITNESS: A commentary.

19 MR. PRESANT: On what others have done, right?

20 THE WITNESS: Generally I would say a commentary. It  
21 could be on what others have done, what they're doing, what we  
22 should be doing, anything that somebody wants to call attention  
23 to to the readership of the journal.

24 MR. PRESANT: Is the peer review process for a journal  
25 article different than the peer review process for a letter to

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1 the editor?

2 THE WITNESS: I haven't been a peer reviewer of  
3 either. I don't know.

4 MR. PRESANT: As an author of this letter do you know  
5 if it went through a different peer review process than a full  
6 journal article with original research would have?

7 THE WITNESS: I don't know.

8 MR. PRESANT: And there were five authors I think you  
9 said listed on this letter.

10 THE WITNESS: I count five.

11 MR. PRESANT: What was your role among the five  
12 authors in drafting this letter that was just over a page?

13 THE WITNESS: Drafting it.

14 MR. PRESANT: You did most of the writing.

15 THE WITNESS: I certainly drafted the original. There  
16 was what's been referred to as word smithing.

17 MR. PRESANT: Did any of the other authors, one of  
18 which I think was your supervisor, right, for your thesis?

19 THE WITNESS: Yes.

20 MR. PRESANT: FBS, Dr. Krane, did he make any  
21 substantive changes to your draft of the letter?

22 THE WITNESS: All of the authors made substantive  
23 contributions.

24 MR. PRESANT: No objection, Your Honor.

25 THE COURT: It's admitted.

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1 BY MS. KLOET:

2 Q Thank you. Mr. Adams, could you turn, please, to Defense  
3 Exhibit B in your binder. Mr. Adams, what is this?

4 A This is my CV.

5 MS. KLOET: Your Honor, I move that Defense Exhibit B  
6 be admitted into evidence.

7 THE COURT: Mr. Presant.

8 MR. PRESANT: I would like to voir dire him on the  
9 qualifications in the CV. If now is the time I would take that  
10 opportunity. But to the document itself, I don't have an  
11 objection.

12 THE COURT: Well, let's just admit the document and  
13 you can voir dire him on his qualifications when he's offered  
14 as an expert.

15 MR. PRESANT: Thank you, Your Honor.

16 MS. KLOET: Your Honor, at this time I would move to  
17 offer Mr. Adams as an expert in computer science and forensic  
18 analysis as it relates to computer science as well as  
19 Probabilistic Genotyping Systems.

20 THE COURT: Okay. You're on, Mr. Presant.

21 MR. PRESANT: Thank you, Your Honor. Leave B up  
22 there, please. Mr. Adams, when I look at your CV I see the  
23 dates when your professional experience started and when your  
24 master's course started but you don't list a date you graduated  
25 with your bachelor's degree. What year did you graduate from

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1 college?

2 THE WITNESS: I received my bachelor degree in 2014.

3 MR. PRESANT: And is there a reason you don't include  
4 that on your resumé?

5 THE WITNESS: No.

6 MR. PRESANT: Just an oversight?

7 THE WITNESS: Does it need to be?

8 MR. PRESANT: No. I'm just curious why there are  
9 dates for some but not others. But if there's no reason,  
10 there's no reason.

11 THE WITNESS: The educational background I have it  
12 there to demonstrate that my master's degree is, is in progress  
13 but incomplete.

14 MR. PRESANT: You've been working on your master's  
15 degree for four years now?

16 THE WITNESS: Yes.

17 MR. PRESANT: You started immediately after you  
18 graduated from college.

19 THE WITNESS: Yes, sir.

20 MR. PRESANT: How long do master's degrees usually  
21 take to attain in computer science at Wright State University;  
22 is it a 2-year program, a 4-year program, longer?

23 THE WITNESS: It's a fairly flexible program.

24 MR. PRESANT: Is there a time with which the degree is  
25 conferred on most of the people who enroll in the program, like

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1 would you say a majority of people finish in two years?

2 THE WITNESS: We have a number -- I don't know.

3 MR. PRESANT: Did you testify previously that you  
4 expected your master's degree to be conferred in 2016?

5 THE WITNESS: It's possible.

6 MR. PRESANT: Was there a time in 2016 when you  
7 expected the degree to be conferred in 2016?

8 THE WITNESS: I sure hoped for it.

9 MR. PRESANT: Well, why do you think it hasn't been  
10 awarded when we are now sitting in 2018?

11 THE WITNESS: My own delays.

12 MR. PRESANT: And I guess would you explain what you  
13 mean by that? The delays. Has there been an issue in drafting  
14 your thesis?

15 THE COURT: Mr. Presant, I really, you know, I know  
16 where you're going with this. And I think it really just is  
17 wasting time. He doesn't have it. He's worked on it. There  
18 can be any number of reasons why he hasn't achieved it. But  
19 let's move on to what are some really significant issues  
20 involving qualifications as you see it.

21 MR. PRESANT: Thank you, Your Honor. The only point I  
22 was going to make was that the process of obtaining a master's  
23 thesis is having experts in the field evaluate your work and  
24 your ability to defend it. And that that hasn't occurred yet  
25 and yet he is in court testifying as an expert in his field.

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1 That was the only point. But the Court's statement is well  
2 taken. I'll move on.

3 THE COURT: Point taken.

4 MR. PRESANT: But your thesis is on, you talked about  
5 it applying the work from ten years ago, right?

6 THE WITNESS: It's built on that, yes.

7 MR. PRESANT: And whose work was that specifically?

8 THE WITNESS: My boss's.

9 MR. PRESANT: Did you testify previously that the work  
10 is built on Dr. Buckleton's research as well?

11 THE WITNESS: It is, yes.

12 MR. PRESANT: So it is in fact built on  
13 Dr. Buckleton's research?

14 THE WITNESS: Yes.

15 MR. PRESANT: All right. You also testified about  
16 STRmix trainings that you've attended. There was one earlier  
17 this year and that was in fact taught by Dr. Buckleton,  
18 correct?

19 THE WITNESS: Yes, it was.

20 MR. PRESANT: You testified about one grant you just  
21 recently received. Have you received any other grants besides  
22 the one you testified to?

23 THE WITNESS: Not other than scholarships, no.

24 MR. PRESANT: Not grants to do research.

25 THE WITNESS: Correct.

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1 MR. PRESANT: Do you hold any academic positions or  
2 have you ever held any academic positions?

3 THE WITNESS: I do not.

4 MR. PRESANT: And you have not ever.

5 THE WITNESS: In the sense of teaching position?

6 MR. PRESANT: Right. Position at a university where  
7 you would be responsible for teaching or doing original  
8 research in an academic discipline.

9 THE WITNESS: I have never been a faculty at a  
10 university.

11 MR. PRESANT: How much are you being paid to testify  
12 here today?

13 THE WITNESS: I'm salaried. My company is being paid,  
14 but I don't see any of that compensation.

15 MR. PRESANT: Did you enter into a contract to be paid  
16 for your testimony today or did the company?

17 THE WITNESS: There's been I believe two contracts  
18 related to this case, and I believe I signed one of them.

19 MR. PRESANT: Okay. Well only one was provided to me.  
20 May I approach, Your Honor?

21 THE COURT: Yes.

22 MR. PRESANT: Do you recognize the document I just  
23 handed you?

24 THE WITNESS: Yes.

25 MR. PRESANT: And is that the contract you signed



NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 regarding your appearance here today?

2 THE WITNESS: I believe it pertains to a number of  
3 things including testimony.

4 MR. PRESANT: Okay. What other things does it pertain  
5 to?

6 THE WITNESS: Generally these contracts -- I would  
7 have to look at it more closely.

8 MR. PRESANT: Feel free to.

9 THE WITNESS: Would you like me to?

10 MR. PRESANT: Please.

11 THE WITNESS: So in addition to a day of testimony,  
12 there is the rest of, most of the rest of the contract is for  
13 consultation and review of materials relating to this case.

14 MR. PRESANT: And there are specific fees that have  
15 been agreed on for each of those things, right?

16 THE WITNESS: That looks like the quote that we  
17 provided, yes.

18 MR. PRESANT: What was the quote you provided?

19 THE WITNESS: I believe this was --

20 MR. PRESANT: Will you just read it for the record,  
21 please.

22 THE WITNESS: \$7730 total.

23 MR. PRESANT: And what are the line items for each day  
24 of testimony and each thing you did for this case?

25 THE WITNESS: Would you like me to read the dollar

## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 values?

2 MR. PRESANT: Please.

3 THE WITNESS: \$113 hotel, \$118 per diem at \$59 per  
4 night, \$200 extras parenthetical taxis, taxes, bag fee. \$549  
5 flight. \$3,000 a day to testify. \$3750-\$250 an hour for  
6 review and consult for up to 15 hours. \$7730 total.

7 MR. PRESANT: Thank you. So you're getting paid  
8 \$3,000 to testify here today, correct?

9 THE WITNESS: My company will be, yes.

10 MR. PRESANT: But your company isn't party to this  
11 contract, you are the party to the contract who signed it,  
12 right?

13 THE WITNESS: I signed it.

14 MR. PRESANT: Now, you testified there was another  
15 company contract. I don't have it. What was that other  
16 contract regarding?

17 THE WITNESS: For the review of the source code  
18 several weeks ago.

19 MR. PRESANT: How much is your company charging for  
20 the review of the source code?

21 THE WITNESS: I don't recall the exact value. But I  
22 believe we billed about \$10,000 for that.

23 MR. PRESANT: And that's the majority, vast majority  
24 of the work that FBS does, correct, is providing services to  
25 defense counsel in criminal cases?

## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 THE WITNESS: That is most of what we do is consulting  
2 with defense attorneys, yes. Revenue wise at least.

3 MR. PRESANT: You testified here today that your  
4 undergraduate computer science degree you had a track in  
5 bioinformatics, correct?

6 THE WITNESS: Yes.

7 MR. PRESANT: Have you taken any courses in forensic  
8 science, academic courses?

9 THE WITNESS: No, I have not.

10 MR. PRESANT: You testified about some mathematical  
11 courses you took, calculus, and linear algebra, I think there  
12 may have been some others. But you've only ever taken one  
13 course specifically in statistics, right?

14 THE WITNESS: One titled statistics, yes.

15 MR. PRESANT: And that was statistics for engineers?

16 THE WITNESS: Correct.

17 MR. PRESANT: So is the point of that course to  
18 provide what engineers need to do, need to know in order to do  
19 statistics as opposed to maybe developing expertise,  
20 theoretical expertise in advanced statistical topics?

21 THE WITNESS: It's a required course for engineering  
22 accreditation.

23 MR. PRESANT: Introductory course.

24 THE WITNESS: It was -- I believe it was a 200-level  
25 course. So a second year course.

## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 MR. PRESANT: Did that course cover the Markov Chain  
2 Monte Carlo method?

3 THE WITNESS: It did not.

4 MR. PRESANT: Have you ever taken a course where the  
5 Monte Carlo method was academically taught?

6 THE WITNESS: Yes.

7 MR. PRESANT: What course was that?

8 THE WITNESS: Systems simulations. I can't remember  
9 the title. I apologize.

10 MR. PRESANT: And was that an application of how that  
11 was used or did you actually study the theory, the development  
12 of the theory behind it?

13 THE WITNESS: It was a combination of both.

14 MR. PRESANT: What about Bayesian decision theory, was  
15 that taught in any of your academic courses?

16 THE WITNESS: Yes.

17 MR. PRESANT: Which one?

18 THE WITNESS: A number of the courses that I described  
19 under the data analysis conversation earlier. Machine  
20 learning, data mining both have heavy roots in Bayesian  
21 analysis.

22 MR. PRESANT: Well the roots behind them in terms of  
23 how the computer operates are Bayesian. But again you're not  
24 doing Bayesian proofs or theory in those courses, right?

25 THE WITNESS: That's not correct.

## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 MR. PRESANT: It's not correct. You do actually do  
2 proofs like you would in a statistics course?

3 THE WITNESS: We did, yes.

4 MR. PRESANT: Now, you testified previously that you  
5 took one year of what would be called hard laboratory science  
6 in college, right?

7 THE WITNESS: I took a year of chemistry but I took  
8 other, at least three other laboratory courses.

9 MR. PRESANT: What were those other laboratory  
10 courses?

11 THE WITNESS: Off the -- well, no, I suppose it's  
12 more than that. It was a year of chemistry, I took units of  
13 micro biology, biochemistry; I don't believe my genetics course  
14 had a laboratory component, but human anatomy and physiology  
15 did. I took two units of that. And I can't recall if there's  
16 anything else off the top of my head.

17 MR. PRESANT: So then why did you testify previously  
18 that you only took one year of hard laboratory science, quote,  
19 unquote if you took all those other courses?

20 THE WITNESS: Did I say that?

21 MR. PRESANT: I can show you the transcript if you  
22 would like me to.

23 THE WITNESS: That might help conceptualize it.

24 MR. PRESANT: Can we bring up the Washington  
25 transcript? It's the defendant is Washington, the case in

## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 Pennsylvania and we are on page 11. So it's this highlighted  
2 portion at the top here. You said, "So the requirements for a  
3 computer science degree at Wright State required a year of what  
4 we would consider hard laboratory science. That would be  
5 general chemistry or general biology. I took general  
6 chemistry." Does that sound like your testimony?

7 THE WITNESS: Yes, sir.

8 MR. PRESANT: So that's why I'm trying to understand  
9 is why you then testified that you had only taken one year of  
10 what you would consider hard laboratory science, now today  
11 you're saying well actually in college I took all these other  
12 scientific laboratory science courses as well.

13 THE WITNESS: In the beginning of this section says  
14 that the requirements for computer science degree requires a  
15 year of a science such as physics, chemistry, I believe  
16 biology, geology, a variety of topics that students can choose  
17 from. I had a year of chemistry. I also elected to take  
18 additional course work.

19 MR. PRESANT: They weren't required for the major.

20 THE WITNESS: No, not for the major.

21 MR. PRESANT: Okay. I understand. I appreciate the  
22 clarification. Have you ever studied population genetics?

23 THE WITNESS: I have.

24 MR. PRESANT: And where did you study that, in the  
25 genetics course?

## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 THE WITNESS: Yeah, there was some in that. And then  
2 reading texts and papers.

3 MR. PRESANT: Now, you also previously testified that  
4 you weren't aware it was possible to get a degree in  
5 bioinformatics, is that right?

6 THE WITNESS: Yeah, I believe we discussed that a  
7 couple months ago. I believe that was discussed.

8 MR. PRESANT: Who was --

9 THE WITNESS: Not you and me.

10 MR. PRESANT: Discussed it.

11 THE WITNESS: There was an AUSA in the Jones case in  
12 New York.

13 MR. PRESANT: That was in November of last year.

14 THE WITNESS: That sounds right, yes, I believe so.

15 MR. PRESANT: And is that still your understanding,  
16 that it's not possible to get a degree in bioinformatics?

17 THE WITNESS: No, he corrected that misunderstanding.

18 MR. PRESANT: And have you after that testimony you do  
19 subsequent research and you agree that there are actually many  
20 such degree programs.

21 THE WITNESS: There's degree programs out there, yes.

22 MR. PRESANT: You also previously testified that you  
23 couldn't take a class where Bayesian theory or the Monte Carlo  
24 method were specifically taught. Do you remember that  
25 testimony?

## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 THE WITNESS: I don't believe I would have said that  
2 you couldn't take one. I might have said I'm not aware of one  
3 specifically called Bayes theory.

4 MR. PRESANT: So you were asked a question in that  
5 Washington case, the transcript we were just looking at,  
6 question, "Have you taken classes in those areas? Answer. I'm  
7 not aware of classes specific to Markov Chain Monte Carlo. I'm  
8 not even aware of classes that are simply Bayesian statistics,  
9 but I haven't taken any courses exclusive to those." Does that  
10 sound like your testimony?

11 THE WITNESS: Yes, that sounds right.

12 MR. PRESANT: And your explanation of it today is  
13 what? That you're still not aware of any such courses?

14 THE WITNESS: I understand that there's courses that  
15 have that as a, those topics as a major focus, yes.

16 MR. PRESANT: Now, you've never developed software  
17 that analyzes or deconvolutes DNA mixtures, is that right?

18 THE WITNESS: I have developed software that simulates  
19 mixtures and evaluates mixtures. I have not developed anything  
20 that would be considered probabilistic genotyping.

21 THE COURT: One second, Mr. Presant. Go ahead,  
22 Mr. Presant. Sorry for the interruption.

23 MR. PRESANT: So your testimony today is that you have  
24 developed software that analyzes DNA mixtures, is that correct?

25 THE WITNESS: I have developed software that evaluates



## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1       them, yes.

2               MR. PRESANT: What's the difference between analyze  
3       and evaluates?

4               THE WITNESS: So I have developed software that  
5       evaluates aspects of mixtures for the purpose of estimating the  
6       number of contributors to them, which is a different  
7       application than the analysis of mixtures for the purpose of  
8       generating comparison statistics to a particular person's  
9       reference profile. I just want to make that clear.

10              MR. PRESANT: I want you to make your testimony clear  
11       no matter what the question is. So would you say that the  
12       software that you work on or that you developed, rather,  
13       interprets DNA mixtures?

14              THE WITNESS: In the sense of deconvolution, no.

15              MR. PRESANT: In what sense does it interpret DNA  
16       mixtures?

17              THE WITNESS: I guess I'm confused by the idea of  
18       interprets. It evaluates it, it takes measurements and makes  
19       decisions based on those.

20              MR. PRESANT: Okay. So your software wouldn't be  
21       software that would look at a mixture and come up with some  
22       sort of probability figure about likelihood of a known  
23       individual being in a mixture of unknowns, right, you haven't  
24       done that?

25              THE WITNESS: Correct.

## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 MR. PRESANT: Okay. And you've never worked in a lab  
2 that does forensic DNA analysis, is that right?

3 THE WITNESS: The actual testing of the samples, no.

4 MR. PRESANT: Yes. Soup to nuts like the Michigan  
5 State Police forensic laboratory, for example, takes samples  
6 in, they do the chemistry in order to extract the DNA, they put  
7 it into an analyzer, they interpret the results; you never  
8 worked in a lab like that, right?

9 THE WITNESS: Correct.

10 MR. PRESANT: You've only ever worked on now we have  
11 this data, let's look at the data, right?

12 THE WITNESS: Our work begins with the output from the  
13 genetic analyzer as well as the documentation of bench notes,  
14 case files and the like.

15 MR. PRESANT: And the course you took in biology, was  
16 that introductory biology?

17 THE WITNESS: Micro biology.

18 MR. PRESANT: Micro biology, was that introductory  
19 micro biology?

20 THE WITNESS: I suppose. It was an undergraduate  
21 level.

22 MR. PRESANT: Did they in that course cover polymerase  
23 chain reactions?

24 THE WITNESS: I don't know where that's been covered.  
25 It's been covered in my courses.

## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 MR. PRESANT: What about DNA extraction, has that been  
2 covered in your courses?

3 THE WITNESS: I don't think DNA extraction has, no.

4 MR. PRESANT: All right. So you wouldn't know if you  
5 were given a sample of DNA how to extract it, right, what the  
6 different considerations were?

7 THE WITNESS: Not without referencing the protocols.

8 MR. PRESANT: And the same thing for doing PCR, you  
9 wouldn't have independent knowledge if I gave you a sample sort  
10 of how many amplification cycles to run, what polymerase to  
11 select, would you know how to make those decisions?

12 THE WITNESS: Not that I would be comfortable dropped  
13 right in a forensic lab today.

14 MR. PRESANT: And while you testified on Ms. Kloet's  
15 examination that you had reviewed forensic procedure manuals  
16 for forensic laboratories, you have never actually worked under  
17 such manuals, right?

18 THE WITNESS: Correct.

19 MR. PRESANT: Now, the only other, you've only  
20 testified in federal court once before today, that was the  
21 Jones case in New York.

22 THE WITNESS: Yes.

23 MR. PRESANT: And that federal judge refused to  
24 consider you an expert in bioinformatics or forensic DNA, is  
25 that right?

## NATHAN ADAMS - VOIR DIRE EXAMINATION - MR. PRESANT

1 THE WITNESS: There was some conversation about that.  
2 Probably be best for me to refer to the transcript.

3 MR. PRESANT: So you wouldn't dispute anything the  
4 judge said in the transcript, if he said, "While he does have  
5 sound work experience in that area," referring to  
6 bioinformatics, "I don't believe at this stage his experience  
7 is sufficient to qualify him as an expert in bioinformatics."

8 THE WITNESS: I believe that's what the judge said.

9 MR. PRESANT: In the Washington case, the one in  
10 Pennsylvania where the defendant was Washington, I know you've  
11 also testified in Washington that's why I want to clarify, the  
12 judge also said that you weren't qualified in DNA, is that  
13 right?

14 THE WITNESS: I'm sorry, this is the Pennsylvania  
15 Washington case?

16 MR. PRESANT: Correct.

17 THE WITNESS: There's additional comments in that one,  
18 and I would refer to the transcript.

19 MR. PRESANT: You would refer to the transcript there  
20 as well. Okay.

21 Your Honor, the government does not object to  
22 Mr. Adams being qualified in computer science and reviewing  
23 code. The government does object to the other in which he was  
24 tendered, I believe it was probabilistic genotyping and  
25 forensic science. I can argue that but I think the Court has

## NATHAN ADAMS - DIRECT EXAMINATION - MS. KLOET

1       seen all the arguments in the briefing.

2               MS. KLOET: Your Honor, may I respond?

3               THE COURT: Yes.

4               MS. KLOET: I'm offering Mr. Adams as an expert in  
5 computer science and forensic analysis and Probabilistic  
6 Genotyping Systems as it applies through computer science and  
7 notions of software programs. The software doesn't exist in a  
8 vacuum. Software exists to -- it's applied across several  
9 disciplines, could be meteorology, it could be video games, it  
10 could be logistics. This is one of those disciplines. So to  
11 the extent to which he is qualified on those subjects, I would  
12 ask he be qualified through the auspices of computer science.

13              THE COURT: As limited by counsel, he's, he is  
14 accepted as an expert.

15              MS. KLOET: Thank you.

16 BY MS. KLOET:

17 Q       Mr. Adams, I understand you just heard the colloquy about  
18 the limitations on your testimony with respect to probabilistic  
19 genotyping software or software systems.

20              With respect to your experience, your professional  
21 experience and your education, can you define as succinctly as  
22 possible what you, how you would define or -- probabilistic  
23 genotyping software systems.

24              THE WITNESS: Probabilistic genotyping is an attempt  
25 to get away from earlier, more threshold based approaches that

## NATHAN ADAMS - DIRECT EXAMINATION - MS. KLOET

1 conclude that a data element is either present or absent, and  
2 assigns weighted values to various explanations of the observed  
3 data.

4 BY MS. KLOET:

5 Q What kind of results does a, for purposes of brevity, I'll  
6 say PGS for probabilistic genotyping going forward, what type  
7 of results does a program like that generate, what form do they  
8 take?

9 A The Probabilistic Genotyping Systems that I'm familiar with  
10 output a likelihood ratio.

11 Q And, again, succinctly as possible, what is a likelihood  
12 ratio to you?

13 A It's a comparison of the relative weights of support for  
14 the evidence given competing hypotheses.

15 Q Are you familiar with the concepts of inclusion or  
16 exclusion as they apply to DNA?

17 A Yes.

18 Q How does the likelihood ratio relate to that concept or  
19 those concepts?

20 A The likelihood ratio is a comparison of these competing  
21 explanations. Since it's a ratio represented as a fraction, if  
22 the likelihood ratio as a whole is greater than one, that  
23 suggests the numerator is larger than the denominator,  
24 therefore there's more support for the numerator. So if the  
25 numerator, which it traditionally is, is the inclusionary

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1 explanation of the data, that is support for inclusion, for a  
2 conclusion that that compared genotype is included. The  
3 opposite of that where the denominator is more supported is a  
4 likelihood ratio less than one, sometimes substantially less  
5 than one, but still greater than zero. That the denominator,  
6 the exclusionary hypothesis, the exculpatory hypothesis is  
7 better supported. And then a likelihood ratio of one suggests  
8 that the numerator and denominator are equivalent or equal, and  
9 there's no more support for one versus the other.

10 Q Would you characterize a likelihood ratio figure as having  
11 a cutoff or being more of a spectrum as related to inclusion  
12 and exclusion?

13 A I would consider it a spectrum. There is no upper limit.

14 Q Can a likelihood ratio that's generated by PGS software  
15 give a conclusive answer to the question of whose DNA may be in  
16 a mixture?

17 A No.

18 Q Why not?

19 A The systems and the structure of the likelihood ratio is  
20 intended to compare the relative support for one of these  
21 hypotheses versus the other. One of the explanations, excuse  
22 me, one of the support for the evidence given those  
23 explanations. And the support, these probabilities are  
24 calculated by underlying models that run through calculations  
25 and are involved or generated, some of the input data is

## NATHAN ADAMS - DIRECT EXAMINATION - MS. KLOET

1 generated from a series of samples that have been taken at  
2 various points. So we have allele frequencies that are  
3 established generally. We have DNA testing that's conducted by  
4 a particular lab, and we have uncertainty that surrounds these.  
5 So there's a wide spread acceptance. I haven't heard anybody  
6 dispute it that there's no ground truth to a likelihood ratio.

7 So the conclusion that any particular value is the  
8 actual correct value is, we can't know it because there's no  
9 ground truth for a controlled sample that this particular value  
10 is the correct value to be outputted by our system.

11 BY MS. KLOET:

12 Q Thank you. Do you in your practice, in your work,  
13 regularly see likelihood ratios that are very large?

14 A Yes.

15 Q How large have you seen them?

16 A We see them regularly exceeding the trillions,  
17 quadrillions, getting up into the words that people typically  
18 don't hear, decillions, octillions, nonillions. They can go up  
19 quite high especially with the newer testing kits.

20 Q If you run a program like STRmix more than once on the same  
21 sample or some data that's based on the same sample, will it  
22 produce the same result each time?

23 A Usually not.

24 Q Why not?

25 A The intention of, one of the intentions of STRmix is to



## NATHAN ADAMS - DIRECT EXAMINATION - MS. KLOET

1 accommodate something that Mr. Lund was touching on earlier  
2 today, that there's, there can be difficulty in conclusively  
3 answering a lot of the mathematical problems that we might be  
4 able to describe formulaically. We need to perform sampling,  
5 we need to perform assimilation. So there is going to be a  
6 random selection of possible answers, and an evaluation of is  
7 this a sufficient sample.

8 So if you take two samples even from the same  
9 population, you're likely to get slightly different values. At  
10 the very least you should get some, somewhat of a different  
11 value. And so these successive simulations or samplings like  
12 taking polls, even if you poll the same group of people you're  
13 going to come up with slightly different numbers based on the  
14 subset that you actually talk to.

15 Q So if you ran a STRmix program again on a particular set of  
16 data, could the likelihood ratio be lower the next time you ran  
17 it?

18 A It could.

19 Q Could it be higher?

20 A It could.

21 Q You may have heard some testimony yesterday from one of the  
22 government witnesses that an incorrect estimate as to the  
23 number of contributors will always result in a likelihood ratio  
24 that is conservative to the defendant. Do you agree with that  
25 statement?

## NATHAN ADAMS - DIRECT EXAMINATION - MS. KLOET

1 A No.

2 MR. PRESANT: Your Honor, I'm going to object. I  
3 think that misstates the testimony. I think she should just  
4 also ask the witness what he knows as opposed to her  
5 confronting him with her summary of prior testimony.

6 MS. KLOET: I'm happy to rephrase my question, Your  
7 Honor.

8 THE COURT: Okay. Rephrase.

9 BY MS. KLOET:

10 Q Will an incorrect estimate as to the number of contributors  
11 in a particular sample always result in a likelihood ratio  
12 figure that is conservative as, as it applies to the defendant?

13 A No.

14 Q Why not?

15 A There's -- why do I --

16 Q What do you base that, your opinion on?

17 A It's been said in a number of articles, it's been published  
18 in a number of articles; I could go into some underlying  
19 principles of it.

20 Q If you could turn in your binder to Exhibit PP. I'll give  
21 you my copy. May I approach the witness, Your Honor?

22 THE COURT: Yes.

23 MS. KLOET: This didn't make it into your binder.

24 Mr. Adams, do you recognize that document?

25 THE WITNESS: Yes, I do.

## NATHAN ADAMS - DIRECT EXAMINATION - MS. KLOET

1 BY MS. KLOET:

2 Q Can you describe it for the Court, please?

3 A It's an article published in "Forensic Science  
4 International: Genetics" several years ago. Do you want me to  
5 read the title?

6 Q Sure, thank you.

7 A The title is, "The effect of varying the number of  
8 contributors on likelihood ratios for complex DNA mixtures."

9 Q Have you read this article?

10 A Yes, I have.

11 Q And what is the thrust of this article?

12 A The title --

13 Q Let me rephrase. What was an important takeaway or  
14 takeaways for you from this article?

15 A The title is a good description of what the article is.  
16 It's an evaluation of how varying the number of contributors  
17 can affect the likelihood ratio calculated for a single sample,  
18 and effectively there is an effect of varying the number of  
19 contributors you assume are present in a mixed DNA profile when  
20 calculating likelihood ratios.

21 Q Can you show me where in that document it indicates what  
22 you just stated? You can turn the pages.

23 A Throughout the whole document it describes what's going on,  
24 but there's on page 96 I believe the fifth sheet that I have  
25 here, table 3 discusses known, knowably incorrect assessments

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1 of the number of contributors and the effect on the likelihood  
2 ratio calculation.

3 Q And what does that table indicate?

4 A It suggests that if you're over, underestimating the number  
5 of contributors to a mixed DNA profile there are observed  
6 occurrences where the likelihood ratio gets higher and a number  
7 where it gets lower.

8 Q Thank you.

9 MS. KLOET: Your Honor, at this time the defense moves  
10 to admit proposed Exhibit PP.

11 THE COURT: Mr. Present.

12 MR. PRESANT: The objection here is this was handed to  
13 me this morning as we sat in the courtroom. The government  
14 hadn't seen it before despite the fact that there was a lot of  
15 literature submitted in support of the briefing, and had it  
16 been handed to me before the proceeding commenced, I would have  
17 asked Dr. Buckleton or one of the other government's earlier  
18 witnesses to address it. And so it seems to be a little bit of  
19 a gotcha by the defense that I'm now getting an article  
20 published in 2015 for the first time after the government has  
21 presented its evidence, and seeing the hour in the day I'm not  
22 sure there's going to be sufficient time for rebuttal in order  
23 to explain how if at all this article has any application on  
24 what was done in this case.

25 THE COURT: Ms. Kloet.

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1 MS. KLOET: Your Honor, this article was not  
2 previously provided because it's being offered to rebut what I  
3 understood Dr. Buckleton's testimony to be yesterday. And  
4 perhaps I misunderstood or misheard it. But as I understood  
5 it, was what I previously phrased the question as he testified  
6 that there is no circumstance where an error in the number of  
7 contributors could generate a likelihood ratio that would be  
8 prejudicial to the defendant.

9 THE COURT: That was my understanding of the testimony  
10 too. And the objection is overruled. The exhibit is admitted.

11 MS. KLOET: Thank you.

12 BY MS. KLOET:

13 Q Mr. Adams, I would like to talk to you about the concept of  
14 validation which we have talked a lot about over the last  
15 couple of days. Generally speaking, and succinctly as  
16 possible, what is a validation study in your experience?

17 A Validation study within the forensic DNA community or just  
18 generally?

19 Q Generally speaking. Start there.

20 A The premise of validation is to go through a series of  
21 tasks to evaluate whether a novel product to process works as  
22 intended, appropriately solves the problem it's intended to  
23 address.

24 Q If it's important, why is it important?

25 A It's important to have some degree of confidence that a

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1 newly developed or newly adopted method, way of doing things  
2 works appropriately, works as you understand it to work and as  
3 you expect it to work.

4 Q What is the importance of validating software that  
5 calculates a likelihood ratio such as Probabilistic Genotyping  
6 Systems?

7 A It's inherently difficult to -- perhaps I should start from  
8 another aspect.

9 For some systems it's intuitively straightforward to  
10 observe if they are working correctly. Previously there was an  
11 analogy to driving a car. That if you get in your car and you  
12 drive your car and you arrive at your destination safely and  
13 soundly, the vehicle worked as expected. Likelihood ratios are  
14 difficult to do. There's no innate ground truth. We don't  
15 have a particular destination to arrive at to that we know that  
16 when we arrive there our process has appropriately worked.

17 So for developing software that calculates, that is  
18 intended to address degrees of uncertainty, and which, as  
19 there's been much conversation as well, likelihood ratios are  
20 inherently difficult to understand and convey, there's a  
21 difficulty in determining when we have arrived at a properly  
22 working software product.

23 Q Thank you. How does one base his or her confidence in a  
24 software program?

25 A For a rigorous validation study would involve the

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1 identification and execution of a number of tasks intended to  
2 inspect and evaluate that system. This is general to the  
3 development of all processes and products. But it's, might  
4 have qualitatively more importance to do for systems that have  
5 difficult to assess outputs.

6 Q Are there specific industry standards and practices used in  
7 the field of software development and testing for validation of  
8 software programs?

9 A Yes, there are.

10 Q Who sets these standards?

11 A There's a number of standards setting bodies that deal with  
12 software standards. There's the IEEE that we have mentioned  
13 before is known for developing standards, many of which  
14 developing standards specific to the development, maintenance,  
15 testing, inspection of software. And many of these standards  
16 have gone on to be adopted by international organizations like  
17 the ISO organization, which is the international standard  
18 setting body, and have also been adopted by countries formally  
19 at a federal level or at a federal departmental level have  
20 adopted IEEE standards, or ISO has set standards from,  
21 developed by other organizations and those have been adopted.  
22 So there's a wide variety of who set them and where they have  
23 been set. Organizations are also free to develop their own  
24 standards, but obviously there's a good baseline to adhere to  
25 with ones that are recognized at national, international

1 levels.

2 Q Can you give some examples of I think you referenced  
3 government organizations or countries that utilize these  
4 standards. Can you give some examples of those?

5 A Yes. There's a number of federal agencies or departments  
6 do recognize specifically IEEE standards, but have published  
7 their own standards as well. Sometimes within a standard  
8 specific to a particular industry there might be industry  
9 specific language and then a general reference to a general  
10 standards document saying that this is how generally software  
11 should be developed. And these are the specific things to know  
12 about its application in here.

13 So the Food and Drug Administration has validation  
14 guidelines for software for medical devices; for safety  
15 critical systems in nuclear power plants there are similar  
16 guidelines from the Nuclear Regulatory Commission; the State of  
17 Michigan has validation guidelines and many of these reference  
18 IEEE standards directly. Some of them reference another kind  
19 of paradigm of standards which is the CMMI model which is,  
20 stands for the Capabilities Model Maturity Integration.

21 Q Where was that developed?

22 A That was developed at the Software Engineering Institute at  
23 Carnegie Mellon University, but it's since become kind of a  
24 spinoff organization separate from the university. But these  
25 methods involve outside appraisals, appraisals by outside



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1 personnel of your organization of your methods, your  
2 documentation, your standards and guidelines. And effectively  
3 assign you a scale, a grade on to what quality level you adhere  
4 to. They have a scale from zero to five. But so as opposed to  
5 validating a particular product specifically, that approach  
6 evaluates a development organization as a whole to demonstrate  
7 that when this organization developed software, they developed  
8 it to this minimum level of criteria.

9 And so there's references to IEEE, to CMMI throughout  
10 state, federal governments, private organizations.

11 Q Thank you. Could you give some examples of types of  
12 software programs that this guidance could apply to?

13 A There's a particular IEEE standard that's about  
14 verification and validation of software systems. It's IEEE  
15 standard 1012-2012. There's a more recent version as well  
16 updated in 2016. But that, like many IEEE software standards,  
17 opens with a brief statement that says that this standard  
18 applies to all software. So it certainly could be used for the  
19 development of apps for your Smart phone, for navigation  
20 systems in airplanes, for navigation systems in cars, for video  
21 games, for anything that has a software component, that  
22 component can be managed with an IEEE standard process.

23 Q Are these standards that you reference, are they publicly  
24 available?

25 A Yes. Anybody can order them.

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1 Q So let's talk about the standards themselves a little bit.  
2 What's one of the preliminary considerations -- I understand  
3 there is probably many of them, correct, is that fair to say?

4 A Many considerations?

5 Q Many standards.

6 A There's many standards, yes.

7 Q So let's just talk about some of the ones you may consider  
8 most important in this context.

9 A Okay.

10 Q Can you give me an example of a standard that you're  
11 referencing?

12 A I mentioned IEEE standard 1012-2012. There's that  
13 describes processes that can be undertaken for software  
14 validation. There are certainly a component of validation is  
15 going to be the generation and examination of software test  
16 documentation which is codified in another standard, IEEE  
17 standard 829. There's a standard that generally describes the,  
18 it's called Software Life Cycle Management, so how your  
19 software is conceived all the way through replacing it with  
20 something else is described in a standards document.

21 So this is unification of terminology and explanation  
22 of what steps connect to each other, various tasks that should  
23 be undertaken at various points in time. So those are three  
24 that have been directly referenced in forensic DNA guidance  
25 materials, those three IEEE standards.

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1 Q When you say specifically referenced, where were they  
2 specifically referenced?

3 A In 2016 there was a publication by ISFG which was mentioned  
4 yesterday at least, the Guidelines for the Validation of  
5 Probabilistic Genotyping Systems by ISFG.

6 Q Should be a document on your screen. Do you recognize  
7 that?

8 A Yes, that's the article that I'm mentioning.

9 MS. KLOET: Your Honor, I believe for the record, this  
10 was previously admitted.

11 THE COURT: As what? Number or letter?

12 MS. KLOET: It was Government's Exhibit 23 was the  
13 channel through which it was admitted. It's also Defense  
14 Exhibit BB.

15 So, anyway, you were saying that in forensic science  
16 there are references to IEEE. Are those references expressed  
17 in this article?

18 THE WITNESS: Yes.

19 BY MS. KLOET:

20 Q Let me ask you first. Have you had a chance to read this  
21 article?

22 A Yes.

23 Q Okay. Now you can answer the second question. Are those  
24 standards referenced in this article?

25 A Yes, they are.

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1 Q In what sense?

2 A I believe it's on the next page, there's a statement about  
3 how they are --

4 Q I'm sorry to interrupt you. You can see it if it's hard to  
5 see on your screen at BB.

6 A I believe the third paragraph of the first page, but -- it  
7 says, "International industry standards apply to software  
8 validation, verification and test documentation." And citation  
9 16 and 17 are two IEEE standards documents.

10 Q Okay. Thank you. Is there anywhere else in this document  
11 that you wish to call to the attention of the Court with  
12 respect to this topic?

13 A The next sentence suggests that these general standards can  
14 be simplified and extrapolated to forensic genetics, and that  
15 citation number 18 I believe is to a standard that the FDA  
16 published in or around 2002 about standards for medical  
17 devices, software that run medical devices.

18 Q Are there any other points in this article you would like  
19 to highlight before we move on?

20 A Not regarding software standards.

21 Q Is there something that should -- are there different  
22 levels of standards depending on the type of issue you're  
23 dealing with?

24 A You would expect at the very least the scope, depth,  
25 breadth of the activities that you're undertaking in order to

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1 ensure adherence to a particular development, process, or plan  
2 would be, would get more attention, would get more energy and  
3 effort the more important that product is, that software  
4 program is.

5 Q What do you mean by the more important that software  
6 program is? Is there some sort of analysis that is undergone  
7 to make that determination?

8 A There's discussion in these documents and these IEEE  
9 standards documents and other documents that suggest a risk  
10 analysis is appropriate to undertake when constructing software  
11 products. So this risk analysis would be what are the  
12 consequences of failure of the software; if this software  
13 malfunctions, what can happen? There's gradation of both the  
14 severity and the expected frequency of software failures.

15 Q Can you briefly describe for the Court the gradation that  
16 you just referred to?

17 A So the severity can be ranked in terms of the degree that  
18 the consequences affect someone or something. So these are  
19 often described in terms of financial loss or damages, loss of  
20 human life or physical, physical damage to a person or  
21 property. Environmental damage is often discussed.

22 And then once it's identified, what the consequences  
23 of these failures could be, we also should take a look into  
24 quantifying if possible the expected rates of these occurring.  
25 It's much different to have a program that is moderately

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1 failing regularly than it is to have a program that will  
2 catastrophically fail infrequently. Those are qualitative  
3 decisions that, sometimes qualitative, oftentimes can be  
4 quantitative valuations and considerations that can be made  
5 when identifying if we should adopt a program, how we should  
6 adopt it, if we need to double back and perform more thorough  
7 evaluations, things like that.

8 Q How does that determination then inform the verification  
9 and validation process you referred to earlier?

10 A Right. So the verification and validation process, at  
11 least as I speak of that, unless I specify otherwise, be safe  
12 to assume that I'm talking about the one outlined in the IEEE  
13 1012. That process is laid out as effectively chapters of  
14 software development, and that's not to say that once you  
15 complete a chapter you can't go back. But within these  
16 chapters of software development you have the definition of  
17 software behaviors, you have turning it into an actual program,  
18 testing it; just very briefly that's what we need to do when we  
19 are developing software. And based on the what we call the  
20 integrity level which is influenced by the risk analysis, the  
21 high integrity level systems should have more attention paid to  
22 their quality assurance processes during development and  
23 validation of that software. So we have sometimes a particular  
24 task should be done by every software program that's being  
25 developed, but by the developers of every software program.

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1 But higher integrity level software systems suggest that more  
2 attention, more in-depth investigation should be made into  
3 those.

4 Or there's just entirely different tasks that should  
5 be done by different integrity levels. So this goes back to  
6 the airline or navigation system is likely to have a different  
7 integrity level than a game on your Smart phone.

8 Q So I understand you either directly or indirectly  
9 referenced possible outcomes or consequences of an ostensible  
10 failure, is that a fair statement?

11 A Those are the ones generally considered.

12 Q Consequences to whom?

13 A To the stake holders.

14 Q Who are the stake holders in a forensic DNA analysis?

15 A That's been, that's been discussed and a couple answers  
16 have been given.

17 Q When you say that's been discussed, who has it been  
18 discussed by?

19 A It's certainly been mentioned before that stake holders are  
20 affected by the operation of these systems. I'm thinking  
21 specifically of the draft guidance out of the Forensic Science  
22 Regulator, the United Kingdom's Forensic Science Regulator.  
23 I'm not sure that we have had a conclusive decision defining  
24 comprehensively who could be affected by software failures in  
25 this regard.

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1 Q In the context of forensic DNA analysis, and what you know  
2 about it in your professional experience, could a stake holder  
3 include a person or persons accused of a crime?

4 A Yes.

5 Q Let's talk about other aspects of verification and  
6 validation. I think you modified that phrase to include the  
7 word independent. What do you mean by that?

8 A Independence is a concept that has a couple of different  
9 facets to it. It's suggested by IEEE that software development  
10 processes that need to adhere to integrity levels 3 and 4 out  
11 of 4, the higher of the two integrity levels should be  
12 conducted, their verification and validation inspections,  
13 confirmations, audits, whatever you want to call it, should be  
14 conducted by independent personnel or an independent  
15 organization. And that's from a variety of perspectives.  
16 There's, as they list it, there's managerial independence,  
17 technical.

18 Q What is managerial independence?

19 A To ensure that there's not a managerial pressure that could  
20 be exerted on whoever is reviewing the product or the process.  
21 Suggesting that you need to accept this as the way it is  
22 because your boss wants you to.

23 Q I think you were starting to give other examples or  
24 dimensions of independence. What are those?

25 A There's financial independence as well.



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1 Q Can you describe that?

2 A Whoever is conducting the investigation, if they are  
3 financially dependent on the original developer, then there is  
4 the potential for I suppose what you could call a conflict of  
5 interest that they might be hesitant to call out particular  
6 deficiencies of the software development process if their  
7 paycheck could be affected by it.

8 Q Is there any other dimension of independence?

9 A There's a technical component as well.

10 Q What is that?

11 A So if you have people who are not actually separated, that  
12 if they have a whole lot of overlap of the technical knowledge  
13 about the particular product, then they might share biases or  
14 favoritism to particular components of the development process.  
15 If your buddy in the desk next to you is the one who wrote it,  
16 then you might know how he thinks it should work but perhaps  
17 not how it should work.

18 Q Without some level of independence in the validation and  
19 verification process, what type of assurances would one have  
20 that a software program works properly?

21 A Without independence?

22 Q Without the type of independence you just described, yes.

23 A Well, we would presumably have very similar assurances. We  
24 just, we ourselves wouldn't be sure that they were actually  
25 adhered to as rigorously as they should have been. It's

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1 unlikely that someone with, for example, the financial  
2 independence is simply going to refuse to conduct something  
3 like this. Unless they are declaring it's for a conflict of  
4 interest reason.

5 Q Just give me one moment. So can you just explain for me  
6 exactly, not precisely, but generally what is being evaluated  
7 in this V&V process, what is being looked at?

8 A There's a long list of materials that we expect rigorous  
9 software development practices to generate and to require at  
10 various stages of the process. So one of the early, other than  
11 this risk analysis, one of the early things that we expect a  
12 software program to have even before it's an actual program,  
13 while it's still a concept, is a list of behaviors that it is  
14 supposed to adhere to, that it's supposed to execute during its  
15 operation. So these are called requirements.

16 And a translation of requirements to more technical  
17 notation can be called specifications. So the specifications  
18 of the system are the detail formalized perhaps mathematically  
19 annotated behaviors of the system before any code actually gets  
20 written.

21 Q Are there, is the concept of issue tracking or tracking  
22 problems involved or related to the V&V process in any way?

23 A Sure. So there's a number of other perhaps not stages but  
24 inputs and outputs of the system activities undertaken during  
25 the software development process. And generally validation

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1 activities are checking to ensure that the appropriate tasks  
2 during software development were undertaken; that we have, we  
3 know our expected software operations that when we turn them  
4 into code, when we program our program, and start evaluating  
5 it, comparing the program against its requirements to make sure  
6 that its actual behaviors match its intended behaviors, its  
7 previously stated behaviors, that nothing got lost or  
8 improperly introduced during the translation from concept to  
9 program.

10 Surely issues will arise, so you can refer to them as  
11 issues. Depending on what they are, there is different jargon  
12 terms to refer to them. If there's a behavior that was defined  
13 in a requirement as a requirement that is, is deviant or  
14 deficient or perhaps entirely missing, that could be considered  
15 a defect, that the program is not adhering to its intended or  
16 advertised requirements.

17 Q So these broad concepts we talked about, or you've talked  
18 about just now, are these concepts that you would characterize  
19 as a necessary component of a reliable software program?

20 A Some of them are necessary to maintain consistency between  
21 any more than a single person developing the software program.  
22 That as programs increase in complexity, effectively nontrivial  
23 programs, especially ones that are intended to be developed  
24 over the course of years and maintained for years, should have  
25 these, these tasks should absolutely be undertaken for them.

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1 Q So zooming out to the 10,000 perspective, in your opinion  
2 why do these types of standards exist in the software field?

3 A There's a number of motivations for adhering to  
4 standardized processes. One of them is simply organizational  
5 efficiency. That if you can anticipate what another party is  
6 doing when you're constructing software, then you can plan  
7 around that. And hopefully be more efficient and productive in  
8 your work.

9 Another one is the recognition that ad hoc or  
10 underdeveloped standards or processes can lead to defects that  
11 have significant consequences.

12 Q When you say consequences, would one of those consequences  
13 potentially be a failure of the software?

14 A Yes. Either a failure of a component or a complete system  
15 failure.

16 Q Can you think of any notable failures of software, specific  
17 examples?

18 A Yes. There's a couple that I regularly mention. In the  
19 '90s there were several software failures for space vehicles.  
20 One of them was the Mars Climate Orbiter which was supposed to  
21 be an unmanned probe sent to Mars, and we effectively lost it.  
22 The investigation into the loss of the complete mission failure  
23 because the probe was lost was it either crashed into Mars or  
24 it shot off into space.

25 That was a software failure that was due to a unit

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1 conversion problem. One contractor developed a software module  
2 that worked in standard units, and another contractor developed  
3 a module that worked in metric. They didn't interface properly  
4 and so as adjustments were sent to the probe it veered off  
5 course.

6 There was an outright explosion of a French rocket  
7 that was unmanned, again, thankfully, but intending to put up a  
8 communication satellite, so both of these losses were  
9 considered to be in the hundreds of millions of dollars due to  
10 the expense that went into them.

11 One of the case studies that's especially for medical  
12 devices and the importance of software quality in the medical  
13 field is a life safety issue occurred in a radiation therapy  
14 machine; the Therac-25 in the 1980s was a new, an update to an  
15 older machine; the older machine had hardware safety interlocks  
16 preventing overdosing, and overdosing of the radiation that's  
17 being outputted by the machine. The Therac-25 got rid of the  
18 hardware and the locks for software only, and due to a bug in  
19 it, a defect, overdoses could occur without the operator  
20 knowing. Sometimes repeatedly administered. And ultimately  
21 caused the death of at least six people directly through  
22 radiation poisoning.

23 Q Do software engineering standards like the ones you  
24 described earlier, do they, are there any specific to  
25 Probabilistic Genotyping Systems?

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1 A No.

2 Q When you reviewed the guidelines -- you testified earlier  
3 you reviewed the SWGDAM guidelines. What did it tell you about  
4 the validations of Probabilistic Genotyping Systems, at least  
5 from their perspective?

6 A The SWGDAM guidelines don't have an emphasis or even really  
7 a mention of software development principles.

8 Q You and I believe at least one other witness referenced a  
9 UK Forensic Science Regulator. Could you turn to Defense  
10 Exhibit LL?

11 A I don't have anything in my --

12 MS. KLOET: That's because I have all copies. May I  
13 approach, Your Honor?

14 THE COURT: Yes.

15 BY MS. KLOET:

16 Q Can you identify this document for me?

17 A It's the draft guidance from the Forensic Science Regulator  
18 for DNA Mixture Interpretation Software Validation.

19 Q What do they recommend with respect to this matter, in this  
20 document?

21 A In regards to software, software standards?

22 Q Yes.

23 A There's a recognition that the standards that do exist and  
24 are common to DNA laboratories do not have much to say about  
25 software, and suggest a greater involvement with IEEE standard

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1 17025, which is software life cycle processes. So there's a  
2 recognition that there's a deficiency and directly suggests  
3 following the software life cycle processes described in that  
4 standards document. And there are a number of tasks explicitly  
5 mentioned in this guidance about software construction and  
6 validation.

7 Q Thank you. Would you please turn to page 26 of that  
8 document? You have a hard copy, don't you?

9 A I do.

10 Q Okay. Does the Court have a hard copy?

11 THE COURT: Yes, I do.

12 MS. KLOET: Okay. We are having technical  
13 difficulties so we will proceed the old fashioned way for now.  
14 Can you describe for me what's on this page?

15 THE WITNESS: It's a section headed Software  
16 Development and Testing.

17 BY MS. KLOET:

18 Q Have you had an opportunity to read this?

19 A I have.

20 Q Can you summarize what it stands for or what it says?

21 A It suggests there's approaches to ensuring software quality  
22 during the construction phase as well as the testing phase of  
23 software development.

24 Q And this document is released by what entity?

25 A I believe they are affiliated with but independent of the

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1 home office of the United Kingdom, the Forensic Science  
2 Regulator.

3 MS. KLOET: Your Honor, at this time I would move to  
4 admit Defense Exhibit LL.

5 THE COURT: Mr. Presant.

6 MR. PRESANT: Voir dire please, Your Honor.  
7 Mr. Adams, regarding LL, what's the date of LL, what's the date  
8 on the document? There is a copyright date on it, right?

9 THE WITNESS: October, I believe of 2017. Around  
10 there.

11 MR. PRESANT: Now, you reviewed the version of STRmix  
12 at issue in this case, we haven't gotten there yet but you  
13 reviewed it, right?

14 THE WITNESS: I'm sorry?

15 MR. PRESANT: You reviewed the version of STRmix at  
16 issue in this case, correct?

17 THE WITNESS: Yes, sir.

18 MR. PRESANT: That's version 2.3.07.

19 THE WITNESS: Yes, sir.

20 MR. PRESANT: When was that piece of code released?

21 THE WITNESS: The code was released to me two weeks  
22 ago.

23 MR. PRESANT: No, I'm sorry. When was it, when was it  
24 released for use?

25 THE WITNESS: The program was written and released



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1 back in 2015.

2 MR. PRESANT: So that code was written in 2015 but  
3 this is a late 2017 guidance document, correct?

4 THE WITNESS: Yes, it is.

5 MR. PRESANT: Is it appropriate in your view to apply  
6 guidance documents from the future to past versions of code?

7 THE WITNESS: I think that the significance of the  
8 document is that there were standards in existence in 2015 that  
9 were not adhered to but are recognized by this document.

10 MR. PRESANT: Where does it say what was in place in  
11 2015 in this document?

12 THE WITNESS: Section 1.6, I believe, references the  
13 software life cycle.

14 MR. PRESANT: I'm looking on page 10 on 1.6, right?

15 THE WITNESS: On the next page, 1.6.2, I apologize. I  
16 gave the wrong standard number earlier. The one I gave was for  
17 the vocabulary, and the life cycle process is the standard  
18 number 12207. But the years following the colon for the  
19 standards referenced in 1.6.2 and 1.6.3 describe when these  
20 standards were last modified or when they were determined to be  
21 their effective date. So 2005 for the vocabulary, 2008 for the  
22 life cycle processes, and then the other international standard  
23 that's BS 15288.

24 MR. PRESANT: So those are standards that are  
25 contained in other documents that are being referenced here but

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1       there are different standards, right?

2               THE WITNESS: They're these British standards. It is  
3 not this Forensic Science Regulator document.

4               MR. PRESANT: Right. It's a separate document.  
5 That's all I'm asking.

6               THE WITNESS: They are different documents, yes.

7               MR. PRESANT: This document, though, was in 2017.

8               THE WITNESS: Correct, it came out in 2017.

9               MR. PRESANT: So what I'm trying to figure out -- let  
10 me ask it this way. Code develops over time, right?

11              THE WITNESS: It can.

12              MR. PRESANT: There are new versions that are released  
13 for code; that's a common thing in software development  
14 generally.

15              THE WITNESS: It can be.

16              MR. PRESANT: And then standards develop over time as  
17 well, correct?

18              THE WITNESS: Yes, sir.

19              MR. PRESANT: Different regulators create new rules;  
20 this is all we do here in the court is deal with rules that are  
21 developed over time, same thing in forensic science or in  
22 computer science, rules evolve as well, right?

23              THE WITNESS: Correct.

24              MR. PRESANT: My question for you is is it appropriate  
25 to look at a piece of software developed at one point in time

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1 and used at one point in time and judge it by standards  
2 contained in a future governing document?

3 THE WITNESS: I have a hard time accepting that best  
4 practices at the time you're making your consideration should  
5 not be relied upon.

6 MR. PRESANT: Okay. Is another way of saying that  
7 that you should, when you're developing a piece of software you  
8 should rely on the best practices that were in place at the  
9 time you were developing it?

10 THE WITNESS: Of course that's true, yes.

11 MR. PRESANT: Okay. And then on the front page of  
12 this document also there's the word consultation. Do you see  
13 that?

14 THE WITNESS: Yes, I do.

15 MR. PRESANT: Do you know what that means?

16 THE WITNESS: It's my understanding that it's a draft  
17 for public comment.

18 MR. PRESANT: And that's what that box indicates  
19 below, that people should respond with comments to what they  
20 think of this proposed document, right?

21 THE WITNESS: Yes, sir.

22 MR. PRESANT: So this is not the final document that  
23 the regulator has even adopted as of late 2017, correct?

24 THE WITNESS: That's correct.

25 MR. PRESANT: We're of course in the United States

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1 right now, not the United Kingdom, and this is a United Kingdom  
2 document, is that right?

3 THE WITNESS: It is.

4 MR. PRESANT: And then on page 26 that Ms. Kloet asked  
5 you about in laying a foundation, there's a sentence, the last  
6 sentence of 6.6.1, would you read that for the Court?

7 THE WITNESS: That starts with this requires?

8 MR. PRESANT: Yes.

9 THE WITNESS: "This requires that the software  
10 developed is tested, and that errors are corrected iteratively  
11 within a quality framework to ensure that the end product  
12 performs to the required standard."

13 MR. PRESANT: Now, it says the quality framework. It  
14 does not say IEEE, correct?

15 THE WITNESS: It does not require IEEE.

16 MR. PRESANT: In your view IEEE is a quality  
17 framework, right?

18 THE WITNESS: It could be used as one.

19 MR. PRESANT: But there are other quality frameworks  
20 as well.

21 THE WITNESS: Absolutely.

22 MR. PRESANT: Your Honor, the government objects on  
23 the basis of relevance considering this is a document that  
24 postdated the release of the STRmix version at issue in this  
25 case. It's a draft document. It hasn't even been adopted as

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1 final by the regulator. The regulator doesn't govern the  
2 jurisdiction that we are in right now.

3 THE COURT: Well, it's admitted for what it's worth.  
4 And subject to the commentary by counsel.

5 BY MS. KLOET:

6 Q Mr. Adams, generally speaking, what kinds of questions  
7 should be addressed in your opinion when evaluating  
8 Probabilistic Genotyping Systems specifically?

9 A One of the large concerns that I have is -- let me back  
10 up. A lot of focus is paid to the inclusionary or exclusionary  
11 trends for probabilistic genotyping conclusions about mixtures  
12 and donors and non donors. So there's the idea that we can  
13 test a lot of samples with known donors and compare them to non  
14 donors, and if you include known donors and exclude non donors  
15 your system is working well. But that's the first step. You  
16 also have an actual value that is outputted. And ensuring that  
17 that value is correct because it demonstrates, it can  
18 demonstrate a different weight, a higher or lower value, can  
19 suggest greater or less confidence or whatever is attempted to  
20 be conveyed by reporting that value.

21 So the correct calculation of that value specifically,  
22 not just that it's above or below one but that it's actually  
23 the correct output is of great significance to me, and it's  
24 difficult because of not having those ground truths to rely  
25 upon.

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1 Q You likely heard testimony the last couple of days  
2 regarding artifacts such as stutter. Is there anything  
3 specifically that someone evaluating a probabilistic genotyping  
4 system under the auspices of standard computer software review  
5 principles should be looking at with respect to that particular  
6 concept?

7 MR. PRESANT: Government objects on the basis of  
8 qualifications. And if it's easier, Your Honor, procedurally  
9 I'll put in a standing objection that if he's asked about  
10 modeling biological phenomenon like stutter or drop-in or  
11 drop-out, or the other biological topics that we have covered  
12 that he isn't qualified to opine on how those things should be  
13 modelled because he doesn't have sufficient training in those  
14 biological topics and I believe it to be outside of the scope  
15 of the Court's prior ruling.

16 THE COURT: Well, I'm not so sure you're correct about  
17 that, Mr. Presant, because the question is stated in the form  
18 of standard computer software review principles. So I think  
19 the question is proper and the witness may answer.

20 MS. KLOET: Do you remember the question?

21 THE WITNESS: Could I have it again?

22 BY MS. KLOET:

23 Q I'll try to recall it. You've heard some testimony over  
24 the last couple of days if you were in the courtroom ostensibly  
25 about artifacts such as stutter. What can you tell me about --

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1 now I'm forgetting the question. What can you tell me about  
2 how that is implicated by the concepts that you just described  
3 with respect to software validation generally as it applies to  
4 Probabilistic Genotyping Systems?

5 A Well, the understanding of what particular models are  
6 intended to be implemented is going to be a core focus when  
7 you're comparing what is actually implemented and consequently  
8 what the likelihood ratio result represents. So these are  
9 those underlying assumptions, however well defined, that are  
10 going to form the basis of the result.

11 Q So under these standards software guidance and/or  
12 principles, whatever the correct terminology is, would it be an  
13 important consideration to look at modelling of things such as  
14 stutter artifacts?

15 A All of those things should be codified in requirements.  
16 The important characterization, important characterization --  
17 important characteristics of forensic DNA mixture  
18 interpretation should be considered and written down and tested  
19 against when the software has been constructed.

20 Q So you had a chance to review the version of STRmix  
21 utilized in this case, correct?

22 A Correct.

23 Q How long was that review?

24 A It was over the course of two days.

25 Q Approximately how many hours?

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1 A Maybe a little over 20 hours.

2 Q What did or what materials did your review entail or  
3 activities, just generally speaking then we will narrow it down  
4 a little bit more specifically.

5 A What materials did I receive?

6 Q Yes.

7 A I was provided a computer that had the source code on it as  
8 well as the net beans environment. Net beans is a software  
9 development environment for the JAVA programming language which  
10 STRmix is written in.

11 Q Were you provided validation records in the course of this  
12 review?

13 A I was provided a user manual and three documents that  
14 comprise this version's developmental validation.

15 Q What is the version that you reviewed?

16 A Version 2.3.07.

17 Q You just testified that you reviewed the source code. What  
18 is source code as a software scientist, can you explain that to  
19 the Court?

20 A Source code is what we think about when we think about  
21 programming languages or programming software typically.  
22 Because humans speak in natural language and computers only  
23 work on binary code, we need to have an intermediate between a  
24 natural language and a binary language, since one is in zeros  
25 are fairly unintuitive and inefficient program, and we have



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1 constructed programming languages that represent computing  
2 concepts that we can piece together as a sort of hybrid human  
3 machine language. So it's how we construct software programs.  
4 It's how we write computer instructions.

5 Q Does a review of source code tell you anything specific  
6 about the program itself?

7 A It tells us the actual instructions that have been given to  
8 the computer to be run as a program.

9 Q You also testified that you received three documents that  
10 were offered as validation records, is that correct?

11 A Yes.

12 Q Are those important to review?

13 A Yes, documentation is very important to review.

14 Q Why?

15 A It demonstrates what, what was done, what was intended to  
16 be done, perhaps what wasn't done, as well as informing us  
17 about all of the tasks that were engaged in. So testing,  
18 review, communication, things like that are very important to  
19 trace when we are trying to evaluate the quality of a  
20 particular system.

21 Q After you conducted your review over the course of those  
22 two days, did you write a report?

23 A Yes.

24 Q Defense D, please. Can you turn to your binder to tab D, D  
25 as in David. Can you identify this document for me?

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1 A Yes, it's my statement.

2 Q Is this the statement that you prepared following your  
3 review of the source code in this case and the related  
4 materials in this case?

5 A Yes, it is.

6 MS. KLOET: Your Honor, the defense moves to admit  
7 Defense Exhibit D.

8 THE COURT: Mr. Present.

9 MR. PRESENT: Your Honor, no objection. I just would  
10 note on record that D as well as Government's Exhibit 18 are  
11 already admitted and are subject to the protective order that  
12 the Court has entered in this case. And one of the permissible  
13 uses under the protective order of course is presenting it to  
14 the Court, but the documents should not be filed on the public  
15 record at any time.

16 THE COURT: Okay.

17 MS. KLOET: I have no issue with that, Your Honor.

18 THE COURT: Okay. You know what, it's 2:30. We are  
19 going to take an afternoon break at this point and I think  
20 probably the questioning with regard to this report is going to  
21 be relatively lengthy. So let's come back in 15 minutes at  
22 quarter of 3:00.

23 THE LAW CLERK: All rise. Court is in recess.

24 (Recess taken, 2:28 p.m.; Resume Proceedings,  
25 2:49 p.m.)

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1 THE LAW CLERK: All rise. Court is back in session.  
2 Please be seated.

3 THE COURT: Mr. Adams.

4 BY MS. KLOET:

5 Q Hello, Mr. Adams. If Exhibit D for the defense is not open  
6 in your binder, could you make sure you're there?

7 A It is.

8 Q Thank you. So we were talking about your most recent  
9 review of the source code in this case. Have you previously  
10 reviewed the source code for STRmix?

11 A A different version, yes.

12 Q Can you tell us where that review took place?

13 A In Australia.

14 Q As a computer scientist do you have any concerns about the  
15 -- did you sign an NDA to review the source code in this case?

16 A Yes.

17 Q Did you sign an NDA to review the source code in the  
18 Australian case?

19 A Yes.

20 Q As a computer scientist, do you have any concerns about the  
21 code not being available without an NDA?

22 MR. PRESANT: Objection, relevance.

23 THE COURT: You may answer.

24 THE WITNESS: The nondisclosure agreement or the  
25 requirement of these materials being protected by a

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1 nondisclosure agreement makes it difficult for me to work with  
2 other folks on projects about STRmix and whatever the protected  
3 materials are. So, yes, it is a concern to me. I can't, I  
4 can't call up a biologist or a statistician and say, hey, what  
5 do you think about this if it's something that I learned during  
6 the protected review.

7 BY MS. KLOET:

8 Q In your review of version 2.3.07 in this case, did it  
9 appear to you that the principles of software validation and  
10 verification that we discussed today or to which you testified  
11 today were employed as applied to that particular program?

12 A Some, some principles that we discussed and could be mapped  
13 to particular standards, but certainly not all. And I would  
14 characterize it as not particularly many.

15 Q What were some of those standards that were missing or not  
16 met?

17 A A quantified objective evaluation of the scope of testing  
18 is something that I haven't seen or heard reference to which is  
19 ultimately one of the most important things that I think  
20 generally in software, but specifically for this type of  
21 software, it's important to know exactly how well it has been  
22 tested. So I understand there's concept and the idea, the  
23 premise this STRmix had been tested many times. It's a very  
24 general word testing, and it isn't particularly differentiated;  
25 different types of testing aren't typically differentiated in

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1 those kinds of conversations. Sometimes it just means they put  
2 mixtures through it and see what came out when the mixtures  
3 were deconvoluted which is due to the difficulty with the  
4 ground truth is perhaps not quite testing. It's studying,  
5 evaluating but it's not quite what a software developer might  
6 consider to be testing. And there is other things addressed  
7 both today and as well as in my declaration that were missing  
8 and perhaps do exist or were missing and we don't know if they  
9 exist.

10 Q Let's focus on a few parts of your observations as a result  
11 of that review. You testified earlier to the concept of risk  
12 analysis and I think integrity levels. In your review of the  
13 STRmix program, were you provided with any information that an  
14 integrity level assessment was performed?

15 A I haven't seen an integrity level assessment or a risk  
16 analysis.

17 Q In your review of the version 2.3.07 of the STRmix program,  
18 were you provided with any requirement or specification  
19 documents?

20 A Not in the sense that I understand them. I understand that  
21 something called requirements might exist. I'm not exactly  
22 sure what it is or how it exists.

23 Q Can you elaborate on that a little bit?

24 A Requirements are most useful when they are an essential  
25 document that are accessible and language in a format

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1 accessible to whoever needs input on those requirements. So  
2 for a system that requires input from biologists and  
3 statisticians and software developers, perhaps computer  
4 scientists with the algorithm design, we would like to see a  
5 requirements document that has point by point with subchapters  
6 of this particular aspect of the program as opposed to do X, Y  
7 and Z. And that language ideally should be testable. It  
8 should be verifiable. We should be able to test against it to  
9 have hopefully clear fail/pass criteria on how we test it, how  
10 much we test it, how we identify the different degrees of  
11 testing are sufficient. And then the related specifications  
12 documents as well. I haven't heard any mention of those.

13 Q Did you observe any specification documents in the course  
14 of your review in this case?

15 A No.

16 Q You also testified earlier about the matter at issue  
17 tracking or bug tracking I think you referred to it. In your  
18 review did you find evidence of issue tracking in accordance  
19 with the generally accepted software standards you previously  
20 testified to?

21 A Not issue tracking. There might be a little confusion  
22 about Github, what Github is. It was mentioned yesterday, I  
23 believe. That G-I-T-H-U-B service.

24 Q As a threshold matter can you explain generally what Github  
25 is?

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1 A Right. It's an implementation and a free service of GIT  
2 which is a version control system. Version control system is  
3 like tracked changes in Word so that you can see what used to  
4 be there, that it was struck out, and new text was inserted.  
5 Source code documents can be similarly tracked. But a full  
6 software program might involve hundreds or thousands of source  
7 code documents so you need a system to help automate and manage  
8 the modifications that you make to your system as you're  
9 developing it or as you're maintaining it, and need to make  
10 updates and upgrades or fixes for defects.

11 A component of this is that their issues can be  
12 associated with modifications to your program. So to resolve  
13 an issue you might have to modify your program. So Github does  
14 have the capability of working as an issue tracker, but I would  
15 think it's primarily known as a version control system. So  
16 those two are related but definitely discrete concepts.

17 So I understand that there's references that this  
18 version of STRmix was or at least partly maintained in a Github  
19 repository. I'm not quite sure what the issue tracking  
20 capabilities were at this stage of development.

21 Q Was that offered to you or provided to you at the time of  
22 your review?

23 A No.

24 Q As a result of your work or as a result of your review in  
25 this case, do you have notice of any actual defects in this

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1 version?

2 A There's several defects that are generally known and  
3 published, and one problem that I identified as known to MSP as  
4 well and several possible issues in this program.

5 Q If you could turn to Defendant's Exhibit AA in your binder,  
6 please, which is also displayed on the screen. Have you seen  
7 this document before?

8 A Yes.

9 Q What is it?

10 A This is a document that I've seen from Dr. Buckleton's  
11 website that describes problems that were identified and fixed  
12 in STRmix.

13 Q Are there any -- is there any language on this document  
14 that affects or implicates the version that you reviewed in  
15 this case?

16 A Yes.

17 Q Where is that language?

18 A Number 3 was previously identified as affecting this case.

19 Q Is there anywhere else in that document?

20 A So it's difficult to tell because these aren't fully  
21 fleshed out descriptions of what the issues are so they're not  
22 formal notices of defects. They are not explicit references to  
23 how requirements were improperly implemented or failed to be  
24 implemented. So going off, going off the versions that are in  
25 the effect column, you can see that the version used in this



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1 case was affected by most of these defects.

2 Q How is it that you first became aware of the existence of  
3 this document? How did you first -- how did it first come to  
4 you?

5 A I don't know. I must have found it on his website or was  
6 linked to it on his website.

7 Q Is it fair to say it would be a publicly available document  
8 or it was at the time you accessed it?

9 A Yes.

10 MS. KLOET: Your Honor, the defense moves to admit  
11 Exhibit AA.

12 THE COURT: Mr. Present.

13 MR. PRESENT: Yeah, I think there was testimony about  
14 Exhibit 14 being an updated version of that document, but I  
15 think the foundation has been laid. So no objection.

16 THE COURT: It's admitted.

17 MS. KLOET: Thank you.

18 BY MS. KLOET:

19 Q So I would like to call your attention to number 4 that's  
20 listed on this summary here. The language in this, in the left  
21 hand text column references something called a miscode. What  
22 is a miscode in software?

23 A It's not a term that I'm familiar with outside of the  
24 STRmix software development team. But I understand it to be an  
25 inappropriate decision made during the programming of the

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1 system.

2 Q So just to be clear, is miscode a word that you've only  
3 seen in the context of STRmix with respect this -- of software.

4 A I haven't seen it used elsewhere in software.

5 Q Thank you. My initial question was as a result of your  
6 work generally or your review that you performed in this case,  
7 do you have any notice of any actual defects in that version  
8 that we just talked about this one? Are there any other  
9 defects that you have notice of?

10 A So it's difficult to identify something affirmatively as a  
11 defect because that, like I said earlier, you benefit from  
12 having these testable criteria defined in requirements. If you  
13 don't have the requirements, it's difficult to identify  
14 precisely what the behavior of the software is supposed to be.  
15 I can make inferences, I can read the manual, but unless there  
16 are -- and this is why a central document is very helpful with  
17 it; it's difficult for me to positively identify something as a  
18 defect. There is -- there are problems more colloquially I can  
19 describe with the system that were apparent upon inspection.  
20 There were one or two that were discussed in STRmix training  
21 that I was at. And --

22 Q Let me stop you right there. You just said there were one  
23 or two problems, and we will use that term for purposes of  
24 brevity. What were those problems that you observed during the  
25 training?

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1 A So I didn't observe one of them but one of them was shared  
2 as a problem with STRmix that had been fixed, and I believe  
3 that's a reference to something that was also mentioned in the  
4 materials provided to us in this case; the use of STRmix at a  
5 particular time could cause it to redo its result to  
6 effectively not have any random sampling upon successive  
7 executions of it; you're expecting a result with an order of  
8 magnitude but it was giving you the exact same result. And I  
9 believe it was limited to the hours of midnight to 1:00 a.m.,  
10 which is kind of an odd situation. And the change request  
11 indicates that it was fixed and I understand it to be  
12 rectified. I don't have any indication of that.

13 Q So is that a problem you became aware of through your  
14 specialized STRmix training that you attended that was  
15 sponsored by STRmix?

16 A Yes.

17 Q Okay.

18 A Yeah.

19 Q Is that particular problem identified on Defendant's  
20 Exhibit AA, that summary that you retrieved from you think the  
21 website?

22 A The random --

23 Q Yes.

24 A The time and random numbers is not listed in this document.

25 Q Thank you. Were there any other errors or problems, pardon

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1 me, that you observed in your review in this specific case?

2 A Specific to this version of STRmix version 2.3?

3 Q Yes.

4 A There were a couple that I addressed in the declaration.

5 There's one that's identified in the state police protocols.

6 Q If you can go to Defense Exhibit N as in Nicholas, page  
7 118. Do you recognize this document? It's an excerpt of a  
8 larger document.

9 A It looks like a laboratory manual.

10 Q Okay. What can you tell me about the error that you  
11 observed vis-a-vis MSP?

12 A The page that I turned to don't, doesn't have the text of  
13 it.

14 Q If you need a different page we can retrieve it.

15 A Page 118. Okay. So it's described under this general  
16 STRmix protocol section of what I believe is 211, and towards  
17 the end of the, of this section of the protocols it describes  
18 that an analyst typically should not run STRmix twice. One of  
19 the indicators for or to run it twice is if you hit this first,  
20 for this first bullet point, and suggests that STRmix might not  
21 consider all of the potential genotypes at a particular locus;  
22 so if it is not considering all potential genotypes and someone  
23 with a not considered genotype is compared to the evidentiary  
24 item, STRmix has no weight to assign that and it will zero out  
25 the overall likelihood ratio.

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1 Q What does that tell you about the potential effect on the  
2 likelihood ratio?

3 A Well, sometimes during case work STRmix doesn't consider  
4 all of the potential genotypes, but you will -- the diagnostic  
5 as it's described for identifying that behavior is a likelihood  
6 ratio of zero. So there's not been a demonstration to me that  
7 this behavior does not happen when LRs are non equal to zero.

8 Q So I think you just testified that it tends to indicate  
9 STRmix doesn't consider all potential genotypes. Is that an  
10 accurate --

11 A That's reading from the manual.

12 Q Okay.

13 A Would you like me to read that particular section?

14 Q You can. I'm just trying to understand better how that  
15 could potentially affect a likelihood ratio in a given case.

16 A If, if STRmix is supposed to break apart and assign  
17 appropriate weight to different potential genotypes, and it  
18 doesn't do that, then that's going to affect the weights of the  
19 genotypes that it did consider.

20 Q And would that in turn potentially affect the likelihood  
21 ratio that is generated from a run of the STRmix program?

22 A Yes.

23 Q Thank you. Were there -- you heard Dr. Buckleton testify  
24 yesterday, I think, that you have a misunderstanding of some  
25 principle. How would you respond to that?

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1 A It is definitely a complex problem that is replicated  
2 throughout the STRmix code several times, and --

3 Q I'm sorry to interrupt you. But you're referencing this  
4 precise issue that we just discussed before I asked that  
5 question, right?

6 A Well, I'm thinking about a different misunderstanding.

7 Q Okay. So why don't you tell me --

8 A I don't think I misunderstand this. I understand that  
9 Dr. Buckleton considers this to be a diagnostic. I consider  
10 this to be a possible diagnostic of problematic behavior.

11 Q Okay.

12 A Which exists. So, sorry, the misunderstanding that I  
13 understood was mentioned yesterday was about MCMC evaluations.

14 Q Okay. And do you understand the criticism and, if so,  
15 could you paraphrase that for the record?

16 A One of the problems is finding common language in all of  
17 this. So if I could outline what I understand the problem to  
18 be is that I wrote something in my declaration; I understand  
19 that Dr. Buckleton conferred with Dr. Taylor about that  
20 particular thing, that particular statement I made. Dr. Taylor  
21 provided a book chapter which I then read. So this is a series  
22 of steps to go through in order to try to identify if we have  
23 common ground.

24 One of the -- and it could be a problem with the  
25 implementation of this particular functional code. It is

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1 something that I would rather at this point talk with someone  
2 else about before I make a particular conclusion whether or not  
3 this is a defect and a desirable behavior, the one that I  
4 referenced in my declaration that Dr. Buckleton pointed out  
5 yesterday.

6 Q But you're not permitted to do that under the terms of the  
7 NDA in this case, are you?

8 A It would hinder my ability to do so, yes. And my  
9 motivation for further looking into software behaviors of this  
10 particular version of STRmix effectively concludes with this  
11 case.

12 Q Were there any other problems that you observed in your  
13 review of the STRmix software in this case?

14 A There were a number of other issues to varying degrees of  
15 severity. Not having the requirements and specifications  
16 against which I could evaluate test coverage and scope, what's  
17 appropriate to test, which components were tested, how they  
18 were tested, the overall order of the code which I understand  
19 is perhaps the basis of the claims that I'm making mostly  
20 stylistic concerns, which I disagree with, but the cleanliness  
21 of the code was not necessarily orderly or what I would hope to  
22 see with a professionally developed and well maintained  
23 software product. There were a number of locations of code  
24 that used to exist but had been functionally removed from the  
25 software so it was laying there as an artifact of a process

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1 that used to exist, which on some level was helpful to me  
2 because I could identify that the system had changed, the  
3 system had been changed. There was one way of doing things  
4 that was functionally removed but still left in the text of the  
5 source code and then a new method was implemented.

6 So in terms of being able to identify when and where  
7 and what the development was, that was mildly helpful, but  
8 overall it's suggestive of a difficult to maintain code base.

9 Q With respect to what could be characterized perhaps as a  
10 simply cosmetic problem, does that give you any concerns about  
11 the software overall?

12 A Characterizing the manner in which the code is maintained?  
13 Just the orderliness?

14 Q Yes.

15 A It's, it's a cosmetic problem in the sense that maintaining  
16 a clean house or a clean restaurant is a cosmetic problem. Of  
17 course it's pleasant to look at but it's also pleasant to work  
18 in, it's easier to work there if you don't have artifacts, old  
19 things laying around. The not knowing why or when something  
20 was changed, or necessarily who changed it, or if you want to  
21 revert back to the old way of doing things, as that's suggested  
22 by the presence of this nonfunctional code. There's a number  
23 of reasons to not have it, and it's generally frowned upon in  
24 production code. It should be -- it was notable to me that the  
25 code that appeared to be developed by outside parties did not



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1 have that particular feature in it. So the non STRmix code  
2 that was included and used by STRmix but not developed by their  
3 team does not have that as a characteristic of it.

4 Q When you say that, for purposes of clarification, what do  
5 you mean by that? When you say that particular section of the  
6 code that was not developed by STRmix did not have that. What  
7 is that?

8 A The portions of the overall STRmix package that were not  
9 developed by in-house, by that team, did not have the cluttered  
10 commented out, nonfunctional code throughout it as the STRmix  
11 code appears to.

12 Q So were some portions of the code developed by STRmix and  
13 some appeared not to have been?

14 A Correct, yes.

15 Q From your review, could you identify in every instance by  
16 name who wrote the code?

17 A No.

18 Q Why not?

19 A A number of -- so it's my understanding that -- I also  
20 might have a little bit of a misunderstanding -- that there are  
21 several organizations who develop the code; that's ESR and  
22 Duncan Taylor who, I apologize to Dr. Taylor, but he might get  
23 lumped in with ESR, and Niche Vision, which is a software  
24 company in Ohio who licenses and distributes STRmix. There's  
25 also reference made to a company called Orbit who, depending on

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1        what I look at, Orbit appears to enter the software development  
2        process of STRmix at the stage or sometime later depending on  
3        what document I'm looking at.

4                The code developed by two people at Niche Vision is  
5        described as developed by them with contact information, and  
6        generally appears to be tidy, well maintained code. There is  
7        not, there's not many attributions of who wrote the rest of the  
8        code throughout the program, which could indicate who you need  
9        to speak to if you need to maintain or modify it at a later  
10       date, assuming it's not just a monolithic, one-man project.

11       Q     So I think you're still on Defense Exhibit D in your  
12       binder. Can you please turn to page 30? D as in --

13       A     D as in dog?

14       Q     Yes. 30.

15       A     Okay.

16       Q     On this page it indicates there is a section called 4.4  
17       code style, right?

18       A     Yes.

19       Q     Can you talk about some of your observations and  
20       conclusions as expressed in this section of these three  
21       paragraphs of this section of your report?

22       A     Starting from the top, code style is not necessarily the  
23       cleanliness of the code so much as it is the particular method  
24       of construction and maintenance of it. So this is not someone  
25       telling you so much as clean your room, but this is how you're

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1 going to clean your room, but more appropriately it might be  
2 this is how we assemble things here. This is how we build  
3 things to ensure consistency. If somebody else comes in to  
4 look at it, they understand what they're looking at.

5 The second paragraph describes how there's not  
6 consistent authorship declared throughout the code. So it  
7 looks like some portions of the code are written by these Niche  
8 Vision employees, Mr. Alali and Mr. Faris. And other portions  
9 of the code simply have no indication as to who wrote them,  
10 when they were written, when they were modified, how they were  
11 modified, this kind of lineage of how the software developed  
12 over time. And ultimately we are going to be concerned with  
13 why modifications were made, was it a feature edition, was it  
14 fixing a bug, was it fixing a bug that we don't know about.  
15 Those are things that could be documented somewhere, that might  
16 be documented somewhere but I haven't seen.

17 Q The third paragraph references a package called DyNamix,  
18 correct?

19 A Yes.

20 Q What is DyNamix?

21 A It seems to be the central package to the functionality of  
22 STRmix that has been discussed the past two days. So this is  
23 the deconvolution and the likelihood ratio calculation portion  
24 of the program. There's a fairly substantial portion of the  
25 program that's dedicated to software licensing to, like you buy

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1 a license and you load it on to your computer and you load it  
2 into STRmix to make sure it's not a pirated copy of the  
3 software. But I didn't spend much time looking at that because  
4 I was interested in the deconvolution and statistical  
5 calculation sections.

6 The other portions of the program are segregated from  
7 DyNamix. So they can interact, but this DyNamix is a kind of  
8 stands in the center.

9 Q In your report who did you -- who did you indicate you  
10 determine that DyNamix was attributed to?

11 A It was attributed in the code to these three names: Admin  
12 as an administrator, Owner and Dude. But I didn't see any  
13 people's names other than, I'm sorry, within the DyNamix  
14 package, I suppose.

15 Q To step back for a minute I think part of your testimony  
16 today was about how you discovered a bug or learned of one at  
17 your STRmix training, right?

18 A Correct.

19 Q And that wasn't published in those seven miscodes I believe  
20 was your testimony that you found on the website.

21 A That's right.

22 Q Do you have any concerns about the fact that you learned of  
23 an error that was not published in that document?

24 A Yes. I am.

25 Q Why is that?

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1 A The dissemination of inappropriate or knowably incorrect  
2 behavior is something that is important to not just the users  
3 of the software but anybody who has an interest in the  
4 software.

5 Q Can problems in coding or issues that arise in the source  
6 code potentially affect the likelihood ratio?

7 A Yes. But I wouldn't limit it to the source code.

8 Q Can you expand upon that?

9 A Problems anywhere throughout the software development  
10 process can affect the final conclusion reported by the  
11 software. So there's been conversation about models, so the  
12 selection of the appropriate model, the correct translation of  
13 mathematical concepts into requirements language that is then  
14 translated in to source code. So there's a number of  
15 translations that need to occur. You need to actually design  
16 your program. Of course, you need to conduct some sort of  
17 tests however they are described. So having insufficient  
18 testing processes, incomplete test coverage, inappropriate  
19 testing methodologies, all of these things can affect the  
20 overall quality of the software in terms of identifying whether  
21 inappropriate behaviors exist which could affect the final  
22 calculation.

23 Q Could it affect the final calculation or the likelihood  
24 ratio potentially in a way that hurts the defense or defendant  
25 in the context of its use in criminal cases?

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1 A That's possible.

2 Q I think you testified earlier that you had an opportunity  
3 to review some validation records or documents, three documents  
4 related to validation records, right?

5 A Yes, ma'am.

6 Q What was your impressions of those documents?

7 A The materials were provided as a zipped file over e-mail  
8 labeled as something along the lines of developmental  
9 validation. I believe we had requested these originally and  
10 they had, they were provided I believe on the second day of my  
11 review of the source code, but I had access to them for the  
12 entirety that I was writing my report. When I received them, I  
13 believed them to be materials about the validation of the  
14 development of STRmix, but it seems they are more along the  
15 lines of the SWGDAM style definition of developmental  
16 validation.

17 Q What would you say to the fact -- what would you say to  
18 someone who says that they ran this particular software program  
19 on all these different samples and therefore it's been  
20 validated. In the context of your review, is that enough?

21 MR. PRESANT: Objection. Clarification on what are  
22 these samples.

23 THE COURT: I think you need to rephrase.

24 MS. KLOET: Sure, I'll rephrase. What would you say  
25 to the fact that -- I'll be more specific. Dr. Buckleton

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1 testified that they ran this program, STRmix, or that in the  
2 developmental validation process many times. What would you  
3 say to that as it relates to software validation?

4 THE WITNESS: From what I've seen from what was done,  
5 there aren't objective, quantified descriptions of the actual  
6 coverage of the tests conducted. So until that's done, it's  
7 going to be difficult to evaluate the scope and thoroughness of  
8 any validation activity.

9 BY MS. KLOET:

10 Q In your professional opinion, should the likelihood ratio  
11 generated by STRmix program be relied upon?

12 A No, I don't think there's a basis for it.

13 Q Thank you. Is there anything else that we haven't covered  
14 today that you wish the Court to know?

15 A No.

16 MS. KLOET: Your Honor, at this time I would like to  
17 move to admit Defense Exhibit D. I don't think I've done so  
18 yet.

19 THE COURT: Mr. Presant.

20 MR. PRESANT: I thought she had.

21 THE LAW CLERK: I have D admitted.

22 MS. KLOET: Okay. I tend to forget so wanted to make  
23 sure.

24 MR. PRESANT: For what it's worth.

25 THE LAW CLERK: But not N. Did you mean to admit N?

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1 That's fine if not. I'm just telling you what I have listed.

2 MS. KLOET: I don't think Defense Exhibit N is  
3 necessary in light of the fact that the government has  
4 submitted the entire MSP policy manual. Thank you.

## CROSS-EXAMINATION

5  
6 BY MR. PRESANT:

7 Q Mr. Adams, at the beginning of Ms. Kloet's examination she  
8 asked you a question regarding the interpretation of likelihood  
9 ratios and whether you could ever look at any likelihood ratio  
10 and say conclusively the defendant's DNA is in that mixture and  
11 your answer was no, you can never say conclusively that it is.  
12 Correct?

13 A Via likelihood ratio.

14 Q Via likelihood ratio. So and that's just because it's a  
15 probabilistic statement, right?

16 A Generally, yeah.

17 Q So, for example, are you familiar with the Mega Millions or  
18 the Power Ball?

19 A The Lotto.

20 Q Those are Lottos, right. What are the odds of winning one  
21 of those, the Jackpot, do you know?

22 A Pretty high.

23 Q Pretty high. So like 1 in the tens or maybe hundreds of  
24 millions?

25 A Okay.



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1 Q Does that sound reasonable?

2 A Sure.

3 Q So if I bought a lottery ticket today, would you be able to  
4 say conclusively that I was not going to win the lottery?

5 A If it was a valid ticket I could not say that.

6 Q Right. Because it's, there's just some probability and so  
7 the best evidence of whether or not I would win is just  
8 whatever the probability of that ticket being the winning  
9 ticket is, correct?

10 A In a fair system, that seems like a reasonable conclusion.

11 Q Now, you also testified about these IEEE standards, and is  
12 it fair to say, summarize your testimony you think they are  
13 important, IEEE standards, correct?

14 A That they are important?

15 Q Yeah.

16 A I think they are, yes.

17 Q Do you acknowledge that no governing body has stated that  
18 the IEEE standards apply to probabilistic genotyping software?

19 A With the exception -- a government body?

20 Q A governing body. A body that is responsible for the  
21 forensic DNA community. Are you aware of any that has said  
22 IEEE standards, Probabilistic Genotyping Systems have to comply  
23 with these?

24 THE COURT: Is there a body that is responsible for  
25 the forensic DNA community?

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1 MR. PRESANT: I think the Court has heard testimony  
2 that SWGDAM is the prevalent body that governs probabilistic  
3 genotyping in the United States. And there are other bodies  
4 like the ISFG, and perhaps some others that are influential on  
5 the implementation of these.

6 THE COURT: Okay.

7 THE WITNESS: So the guidance bodies that you just  
8 mentioned.

9 BY MR. PRESANT:

10 Q Correct. Or any others that you're aware of.

11 A Well, so the -- they have been recognized but I haven't  
12 seen any say that they need to be adhered to, that specifically  
13 IEEE needs to be adhered to.

14 Q In the Jones case I asked you about earlier you were asked  
15 "The IEEE that you are a member of, that doesn't govern the  
16 forensic DNA community, right?" And you answered, "It's a  
17 professional organization. It does not govern forensics." Do  
18 you still agree with that statement here today?

19 A I do.

20 Q Now, we already looked at the -- well strike that. May I  
21 approach, Your Honor?

22 THE COURT: Yes.

23 MR. PRESANT: I'm handing you a document that's been  
24 entitled IEEE Standard for System and Software Verification and  
25 Validation, and it says it was approved on March 29th of 2012,

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1 is that right?

2 THE WITNESS: I don't see the approval date. But --  
3 I see 25 May 2012.

4 BY MR. PRESANT:

5 Q I have 29 March 2012. Do I have a different version than  
6 you?

7 A I don't know. Could you point that to me?

8 Q I do apparently have a slightly different version than you.  
9 I apologize about that. Oh, you just have a different cover  
10 page.

11 A Okay.

12 Q 29 March 2012, do you see that?

13 A Okay. Yes, I do.

14 Q Are you familiar with this document based on your review of  
15 the IEEE standards?

16 A Yes, sir.

17 Q Would you flip for me to the third page? I guess it's my  
18 third page so it would be your fourth page. It's the page that  
19 at the top states Notice and Disclaimer of Liability Concerning  
20 the Use of IEEE Documents.

21 A Yes.

22 Q Do you see that?

23 A I am there.

24 Q Would you read the sentence at the beginning of the fourth  
25 paragraph there?

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1 A Of the fourth paragraph, the existence after IEEE standard?

2 Q Yes.

3 A "The existence of an IEEE standard does not imply that  
4 there are no other ways to produce, test, measure, purchase,  
5 market, or provide other goods and services related to the  
6 scope of the IEEE standard."

7 Q So is that sentence basically saying it's possible for  
8 there to be other ways to code properly besides complying  
9 strictly with the IEEE standard?

10 A Not just code but produce software in general, yes, there's  
11 many ways to develop reliable software.

12 Q That's consistent with the FSR document we looked at  
13 earlier where it said something about you need a quality  
14 standard but it didn't specifically say IEEE, right?

15 A Not that it must be IEEE, correct.

16 Q Can we turn back to that document? I think it was LL.  
17 Yeah, LL. Do you have it in front of you?

18 A I will get there.

19 Q I think we can put it up on the screen too.

20 A Okay. The FSR draft.

21 Q Yes, correct. Can we go to page 15 if it's up on the  
22 screen? What's on the top of page 15, what section is that?

23 A 522, desired performance parameters.

24 Q Do you have an opinion on whether STRmix complies with the  
25 desired performance parameters outlined here?

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1 A I would have to go over them point by point.

2 Q And you haven't done that already?

3 A I didn't compare the entirety of this guidance to STRmix,  
4 no, I did not.

5 Q Okay. So unless you went over point by point, you wouldn't  
6 have an opinion.

7 A I think that's my opinion, that I would need to go over  
8 this.

9 Q What about page 23? I don't know if we can zoom in on that  
10 paragraph a, 6.5.2a. That's the section regarding conceptual  
11 validation, correct?

12 A Yes.

13 Q And starting from the second sentence of a, it states,  
14 "This is ideally achieved through publication in a  
15 peer-reviewed journal, with details of the statistical model  
16 together with an evaluation of various aspects of the model's  
17 performance." Do you agree with that statement that that is an  
18 appropriate way to conceptually validate a piece of DNA mixture  
19 interpretation software?

20 A I think it's an impressive component of that conceptual  
21 validation.

22 Q And would you agree that STRmix meets that component?

23 A I think that's the community's belief.

24 Q The general probabilistic genotyping community believes  
25 that STRmix complies with 6.5.2a.

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1 A Yes, that's my belief.

2 Q That's your belief as well?

3 A No. It's my understanding of the community.

4 Q Okay. So then my follow-up question is what's your  
5 opinion?

6 A Of this standard or whether STRmix is in conformance to the  
7 standard?

8 Q The second one.

9 A I haven't spent a lot of time thinking about this.

10 Q So you don't want to offer an opinion on that here today?

11 A Not today.

12 Q Let's go to page 24, please. 6.5.3a, I'm going to start  
13 reading after the italicized portion in footnote 31. It says,  
14 "This requires a functional computer implementation of the  
15 model, which can be tested utilizing user-defined test criteria  
16 that can demonstrate whether or not outputs correlate with  
17 expectations for given inputs and the software's intended  
18 functionality. Such testing should utilize a variety of  
19 ground-truth cases for which the composition is known." And it  
20 goes on from there.

21 Do you have an opinion on whether STRmix complies or  
22 STRmix as implemented by the Michigan State Police, rather,  
23 through their internal validation study, complies with that  
24 portion of this proposed guidance document from the UK?

25 A I don't -- so the -- pivoting on the word correlate is

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1 correlate with expectations is what I'm going to focus on here  
2 when I say yes.

3 Q Your opinion is yes, STRmix does comply with it?

4 A I don't have any problem with accepting that MSP's internal  
5 validation is addressing 6.5.3.

6 Q Okay. And I don't want to quibble with you, but I don't  
7 know if there is a difference between, yes, I agree with that,  
8 and I don't have any problem with it.

9 A This is, this is tough. There's not a whole lot of firm  
10 fixed criteria here. There's not a lot of firm fixed criteria  
11 in validations of STRmix describing exactly what answers are  
12 supposed to be reported out.

13 So we can know, as has been discussed, we can know  
14 what certain components of the system are supposed to be  
15 precisely when we perform various calculations. This  
16 "functional computer implementation of the model, which can be  
17 tested utilizing user-defined test criteria" that suggests an  
18 objective and verifiable, falsifiable value that if your system  
19 outputs something within the appropriate range there might be a  
20 give and take; it might be a precise value that must be  
21 outputted. Then that's fine.

22 Q That's fine in that STRmix has implemented through the  
23 Michigan State Police's internal validation has complied with  
24 that, that's what you meant by that's fine, right?

25 A No, I mean that's fine in that's good. That's a good idea.

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1 We should be requiring that. That's consistent with software  
2 testing policies.

3 Q Okay. What I'm trying to get you to is in your opinion do  
4 you believe that STRmix version 2.3.07, all my questions from  
5 here on out will relate to that version unless otherwise  
6 stated, as implemented by the Michigan State Police through  
7 their internal validation study complies with this particular  
8 provision we are looking at. It can be a yes, a no, or I'm not  
9 prepared to offer an opinion on that. I will accept any of  
10 those answers.

11 A And only those answers?

12 Q Well, I suppose that's up to the Court, not up to me.

13 A I would rather reserve final judgment on this.

14 Q That's fine. I'll move on to my next question.

15 A Okay.

16 Q On page 25, can we look at footnote 32? One of the sources  
17 cited here is Taylor et al., 2015 that this particular guidance  
18 document is relying on. Have you reviewed that paper?

19 A I'm sure I have. Honestly, him and Dr. Buckleton, Dr.  
20 Bright, their team are very prolific writers so it's hard for  
21 me to keep straight which article is which.

22 Q You know Dr. Buckleton is one of the authors of that  
23 particular article?

24 A It wouldn't surprise me.

25 Q Page 26, please. This provision, 6.6.1 we looked at it



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1 before, a different question this time. Do you believe STRmix  
2 complies with 6.6.1? Yes, no, you don't want to offer an  
3 opinion, or whatever other appropriate answer you would like to  
4 give.

5 A The language here is pretty vague in that it gives a  
6 checklist item which doesn't describe the scope of that task.  
7 So I would say it doesn't matter a whole lot if there is any  
8 adherence to this particular item.

9 Q This standard doesn't matter?

10 A I'm saying this 6.6.1 needs to be clarified in scope in  
11 order to convey relevant information.

12 Q 6.6.3, do you think STRmix complies with that provision?

13 A It likely does not.

14 Q Do you know if units or parts of the code, important parts  
15 of the code comply with 6.6.3?

16 A It's my understanding that some of the functionality of  
17 STRmix is reproduced in Excel. So that I believe could satisfy  
18 6.6.3 for those components or units, whatever subdivision of  
19 the code you want to call them. I don't know, like I said, the  
20 scope and coverage of those reproductions.

21 Q Well, I'll get to why you might not know in a second. But  
22 first let's finish with this document, 6.6.5, please. My  
23 question there is not with respect to STRmix but just again  
24 here 6.6.5 talks about an appropriate standard, correct, but it  
25 does not specifically reference the IEEE, is that right?

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1 A It doesn't reference any standard.

2 Q By the way, are you familiar with Microsoft software?

3 A Yes.

4 Q Widely distributed, used in this court, in our office,  
5 probably in your office too, right?

6 A I would accept that.

7 Q Does IEEE, I'm sorry, does Microsoft comply with IEEE in  
8 developing its software?

9 A There's -- so as we discussed earlier, there is many  
10 standards. So there is some IEEE standards that Microsoft will  
11 comply with. I have no idea how many they claim to comply  
12 with.

13 Q Would it surprise you to learn that Microsoft does not  
14 comply with IEEE standards?

15 A I know that's not true.

16 Q You know it's not true in what way?

17 A That there are certain specifications for the  
18 representation of data structures, for example, network  
19 communications that I've seen that there are references to in  
20 Microsoft documentation of their products.

21 Q Okay. So there what you're saying is Microsoft you're  
22 aware complies with some of the IEEE standards, right, that was  
23 just your testimony?

24 A Yes.

25 Q My understanding of your criticism of STRmix is that it

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1 doesn't comply with all of the IEEE standards in your judgment,  
2 is that a fair summary of your testimony?

3 A It's my concern that STRmix appears to have no central  
4 standard.

5 Q Is it your testimony that STRmix does not comply with any  
6 of the IEEE standards?

7 A Well, that's a concern, but that would be a way to satisfy  
8 my concerns. The IEEE standards are not what I'm saying STRmix  
9 needs to adhere to; I'm saying that it's a useful template to  
10 get a relative judgment of software quality.

11 Q Okay. So I think that's important right there. That's  
12 kind of getting to the clarification. Your assertion is not  
13 that STRmix has to comply with all of the IEEE standards, is  
14 that right?

15 A That is not my assertion. That is correct.

16 Q Okay. And likewise, therefore, you see no problem if a  
17 large software company like Microsoft complies with some but  
18 not others; your point is that it should be done in a logical  
19 fashion, right?

20 A That -- that's -- failing to comply with a single standard  
21 could have very significant effects. I'm not going to make  
22 that broad generalization.

23 Q It depends on the standard, right?

24 A It depends on the standard, it depends on the company, it  
25 depends on the utility of the software. You know, if we are

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1 talking about managing a lot of the Internet's activity and  
2 adhering to particular networking standards, that's going to be  
3 something different than another standard that doesn't have a  
4 significant commercial or life safety implication.

5 Q It all depends, right?

6 A They are relative, yeah.

7 Q You've written about how open source software is  
8 preferable, right?

9 A There's advantages to it.

10 Q Okay. You would prefer to be open source; I think  
11 Ms. Kloet asked you questions, wouldn't it be easier if it were  
12 open source, freely available?

13 A I tried to be very careful at advocating a particular  
14 position on that topic.

15 Q Now, what about 6.6.8 here? Doesn't 6.6.8 point out that  
16 the use of the open source software presents additional  
17 challenges with regard to software development and testing  
18 because it may not have been written specifically for the  
19 intended application?

20 A I see that.

21 Q Do you agree with that?

22 A I don't know what open source software they are talking  
23 about. If they are talking about open source Probabilistic  
24 Genotyping Systems, then the same challenges apply to all  
25 systems.

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1 Q Isn't this whole guidance document about DNA mixture  
2 interpretation software, so isn't that the type of software  
3 they are talking about?

4 A No. I mean if the type of open source software that they  
5 are referencing in 6.6.8 was specifically intended to solve  
6 probabilistic genotyping, or address probabilistic genotyping  
7 issues, or to be used as a probabilistic genotyping system,  
8 then this whole document applies to them as it does any other  
9 system.

10 Q Why are you so concerned about not taking a clear position  
11 on your view of open source software?

12 A It's not a clear -- it's not an argument with a clear  
13 winner.

14 Q Let's just move on then. 6.7, my last question about this  
15 document. Is it your opinion that or, rather, do you have an  
16 opinion about whether the internal validation at the Michigan  
17 State Police complied with 6.7.1? And, again, as with the  
18 previous questions if you don't want to offer an opinion that's  
19 fine, I can move on.

20 A I don't, I don't know. I haven't spent the time comparing  
21 those two documents, comparing the FSR guidance with the  
22 internal validation standard. Excuse me, the internal  
23 validation document, not standard.

24 Q Now, a lot of this issue comes down to stylistic  
25 preferences for coding, right, your review of the code, your

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1 criticisms, it's about style, not necessarily about substance,  
2 right?

3 A I disagree with that.

4 Q Why do you disagree?

5 A The documentation I would not consider to be style,  
6 documentation and examinations of how extensive testing is. A  
7 lot of the concerns that I have are frustrations with things  
8 that STRmix appears not to have done are frustrations,  
9 substantive frustrations that I have with the field that they  
10 haven't defined them. Just as a couple times I said the  
11 language in this draft guidance needs to be tightened up in  
12 order to be meaningful at all. Concerns that I have that,  
13 substantive concerns about defining the sufficiency, how much  
14 testing, what types of testing need to be conducted, how are  
15 they conducted, who are they conducted by, when and where they  
16 are conducted. These are concerns that I have that I think are  
17 not at all stylistic. Certainly there could be a flare.

18 Q Many of your concerns are with the discipline, the field,  
19 is that right?

20 A Yeah, many of them are, yeah.

21 Q And that field is governed by SWGDAM and ISFG, some of the  
22 other entities the Court has heard testimony about, but you  
23 agree that those bodies haven't adopted your view of how these  
24 software programs should be coded, right?

25 A I don't know that governed by. It might give the

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1 impression that they are mandatory, that they set those  
2 regulations, that they have power to enforce them.

3 Q Well, let's forget about the governed by then. You agree  
4 that SWGDAM and ISFG have not adopted your view, correct?

5 A Correct. I would agree that they are authorities in the  
6 field, certainly not the final.

7 Q You're not a member of either of those bodies, right?

8 A That is correct.

9 Q Now, you reviewed the code twice you testified to and you  
10 produced a report in each case, right?

11 A I did.

12 Q We have only looked at one of those reports. I think it's  
13 the one you produced for this case, and I don't need to go  
14 through them in detail, though, I do have a few questions about  
15 them. First I want to ask you about your opinion on the  
16 differences between version 2.3.07 that you reviewed for this  
17 case, and version 1.8 that you reviewed previously. Do you  
18 think 2.3.07 is an improvement on 1.08?

19 A I can't discuss 1.08.

20 Q Well, I believe you can under the Court's protective order.  
21 Your report in 1.08 was produced in this case so I'm quite  
22 confident you can discuss 1.08.

23 A I haven't gotten any notice from ESR that they are waiving  
24 their interest in the nondisclosure agreement.

25 Q Well, the Court entered the protective order, and then ESR

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1 produced your report in 1.08 to me. So I would ask that the  
2 Court on the basis of the protective order direct the witness  
3 to answer the question. I have the report. I can show it to  
4 him.

5 THE COURT: I need to look at the protective order.

6 MS. KLOET: Your Honor, before the Court makes a  
7 ruling on this particular request, if there is a request, I  
8 just want to express I don't believe Mr. Adams is trying to be  
9 difficult. I understand that he's been threatened in the past  
10 with litigation from ESR, so to -- through cease and desist  
11 letters and the like -- to the extent to which ESR consents to  
12 his testimony vis-a-vis the protective order I think he is  
13 comfortable doing so.

14 THE COURT: Well, I'm not, I don't know who has  
15 threatened him with litigation. But I'm certainly not going to  
16 compel him to answer something that he feels he is precluded  
17 from doing so.

18 MR. PRESANT: Your Honor, I have a copy of the order  
19 if you would like to review it.

20 THE COURT: I would like to look at it.

21 THE LAW CLERK: What docket number is it?

22 MR. PRESANT: It's docket number 70 entered on  
23 May 11th.

24 THE COURT: My docket sheet doesn't go that high.

25 THE LAW CLERK: I've got it here and I can probably



## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 print it.

2 THE COURT: Well, it says in paragraph 1 that, The  
3 Adams 1.08 STRmix report and any Adams 2.3.07 STRmix report are  
4 to be used by the defendant and his counsel solely for the  
5 preparation of their defense. No disclosure of those two  
6 discovery materials is authorized except as necessary for the  
7 preparation of the defense, and such determination of necessity  
8 is to be made by counsel for the defendant, not by the  
9 defendant himself.

10 Disclosure of the discovery materials for purposes  
11 related to defense is permitted to members of the defense team,  
12 experts or consultants, and the Court.

13 All parties will take reasonable steps necessary to  
14 ensure that the discovery materials are not improperly  
15 disclosed.

16 Well, I think you need to, you need to proceed  
17 carefully. Paragraph 5 says, "This Order does not permit the  
18 disclosure of any trade secrets relating to STRmix other than  
19 as set forth in the Order and specifically it does not permit  
20 the disclosure of the STRmix source code or portions thereof,  
21 or accompanying materials provided by ESR in connection with  
22 Mr. Adams's review, except to the extent necessary to report,  
23 to produce a report on 2.3.07, and to testify regarding his  
24 review, in this case only. This Order does not abrogate the  
25 obligations of any nondisclosure agreement that Mr. Adams has

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 entered into with respect to review of the code.

2 Tell me where you're going with your questioning,  
3 Mr. Presant, with regard to 1.08.

4 MR. PRESANT: The only point I want to make with  
5 respect to 1.08 is I want to get his assessment of whether the  
6 newer code is an improvement upon 1.08, then I want to compare  
7 his qualitative baseline conclusions in each of those reports.  
8 And the government is relying in part on the parts of paragraph  
9 5 that make clear he's bound by those agreements but except to  
10 the extent that it restricts his ability to testify regarding  
11 his review of STRmix's source code, or STRmix's code again in  
12 this case only. I was the primary drafter of this document,  
13 though it was filed or it was entered after a joint motion was  
14 filed and Ms. Kloet reviewed it. And I'll represent to Your  
15 Honor that the way this document came to be is we wanted to  
16 make sure Mr. Adams's testimony was not restricted in any way  
17 in this case, and so I presented this document to ESR's  
18 attorneys to make sure they would be fine with the disclosure  
19 of the earlier report so that he could ask, he could be asked  
20 questions about it. And they are not parties to this case so  
21 would not have been appropriate for them to move in this court  
22 for a protective order, but as an officer of the court I can  
23 tell you that they have reviewed this document and approved it  
24 before Ms. Kloet and I jointly moved for the Court to enter it.

25 THE COURT: Here's what I think based on my reading of

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 this document. I think he can properly within the bounds of  
2 the agreement answer the question whether 2.3.07 is an  
3 improvement or whatever other word you used on 1.08, but I'm  
4 not totally confident that you can do a point by point  
5 comparison of the two.

6 MR. PRESANT: I'm not going to go point by point. I'm  
7 only going to ask about the conclusion from 1.08, otherwise I'm  
8 going to review some issues about 2.3.07.

9 THE COURT: Let's give it a start and we will see  
10 where we go. But I do think your first question can be  
11 properly answered within the bounds of the agreement.

12 MR. PRESANT: Thank you, Your Honor.

13 BY MR. PRESANT:

14 Q So Mr. Adams, I'll ask you again, qualitatively based on  
15 your review of 1.08 and 2.3.07, do you have an opinion on  
16 whether 2.3.07 is an improvement upon 1.08?

17 A Can I ask Your Honor something?

18 THE COURT: Sure.

19 THE WITNESS: In the nondisclosure agreements I'm  
20 required to ask for all reasonable measures to make sure that I  
21 don't disclose anything if I'm compelled to to people who  
22 aren't privy to that information. So these are nondisclosure  
23 agreements that are separate from subpoenas or court orders  
24 that I signed personally with ESR; that if I am directed to  
25 share any trade secrets or protected information, I'm to ask

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 for all appropriate reasonable precautions.

2 THE COURT: Well, that first question I don't think  
3 implicates any of that. Because he is not asking you for any  
4 specific information about either of the two versions of the  
5 software. He's just asking you is one better than the other in  
6 your opinion.

7 THE WITNESS: Respectfully, my opinion could only be  
8 arrived at by reviewing protected information.

9 THE COURT: I get that. But you're not disclosing any  
10 of it. With the answer to that question, you're not disclosing  
11 any information that you have that other people can't have  
12 under the agreement. Okay? You see what the distinction is?

13 THE WITNESS: I don't. Unfortunately, I feel  
14 uncomfortable. I'm not a lawyer. My lawyer hasn't reviewed  
15 the agreements in this context. Certainly the nondisclosure  
16 agreement for this case, but there is a separate nondisclosure  
17 agreement that we arrived at two and a half years ago for the  
18 other review.

19 THE COURT: In answering Mr. Presant's fundamental  
20 question, is the development of 2.3.07 an improvement on 108,  
21 you're not disclosing anything except your opinion. There's  
22 no -- it's a, far as I'm concerned, and I don't, I don't think  
23 I'm totally out of bounds, as far as I'm concerned there is no  
24 disclosure of anything there, except for your opinion.

25 THE WITNESS: I have been threatened by ESR for

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 sharing no opinions.

2 THE COURT: Well, you know I certainly can't force you  
3 to answer. I'm not going to hold you in contempt for failing  
4 to answer but I do think that you are being overly cautious  
5 because I don't think there is, there would be any grounds on  
6 which they could justifiably claim that you had made a  
7 disclosure in violation of a nondisclosure agreement by simply  
8 stating your opinion.

9 THE WITNESS: I am not trying to be difficult.

10 THE COURT: I'm sure you're not. I'm sure you're not.  
11 But I also think that you are being overcautious under the  
12 circumstances.

13 MR. PRESANT: I'm sorry, Defense Exhibit D has already  
14 been entered into evidence, correct?

15 THE COURT: Yes.

16 MR. PRESANT: And that's your report from the code  
17 review in this case.

18 THE WITNESS: Could I turn to it to confirm that?

19 BY MR. PRESANT:

20 Q Please.

21 A My code review in this case.

22 Q Can we bring it up? I have it marked also if it would be  
23 easier.

24 A Yes, that's my statement in this case.

25 Q And you don't have any concerns about the fact that that

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 was disclosed here?

2 A Not at all.

3 Q Let's go to your conclusion. Your conclusion in this  
4 report was that STRmix should not be relied upon, is that  
5 right?

6 A I'll accept that at least as a paraphrasing.

7 Q I think I found that language in here somewhere.

8 A It might.

9 Q Is that your opinion in this case, STRmix shouldn't be  
10 relied upon?

11 A Yeah, until additional methods of software quality  
12 assurance have been undertaken.

13 Q And your opinion in the 1.08 report was that STRmix should  
14 be questioned, is that right?

15 A Honestly I can't discuss it.

16 Q So we would have to introduce your report into evidence to  
17 get that before the Court, is that right?

18 A I don't know the legal procedures for that.

19 Q Well, hypothetically, if that were your opinion that it  
20 should be questioned, and now you're saying it should not be  
21 relied upon, this later version that's undergone additional  
22 developmental work, does that make sense to you that you would  
23 take a more aggressive position even after the software had  
24 been developed further?

25 A If a version of software has gone from should be questioned

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 and then later in its development it should not be relied upon,  
2 is that your question? Is that an odd position to take?

3 Q Well, well, you know, I think I made the point so I'm just  
4 going to move on in the interest of time.

5 Let me ask you this. Is getting source code important  
6 for you to do a full review, that's something you care about,  
7 getting the source code, right?

8 THE WITNESS: Generally.

9 BY MR. PRESANT:

10 Q Can we go to page 16 of the report, please? You were  
11 granted access to the source code in this case, correct?

12 A Yes.

13 Q And yet you write, if we can zoom in on this area, "This  
14 review should not be considered comprehensive or complete."  
15 Right?

16 A Correct.

17 Q You were given what you wanted in this case, access to the  
18 source code; why didn't you do a comprehensive or a complete  
19 review?

20 A It's estimated that software testing or more generally  
21 verification and validation processes during software  
22 development should take somewhere between ten and maybe, excuse  
23 me, around 35 or 40 percent of the total budget. I was given  
24 20 hours to inspect a program that's developed over the course  
25 of the past seven years.

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 Q Okay. You were given 20 hours by whom, defense counsel,  
2 correct?

3 A 20 hours was the agreed upon amount.

4 Q Agreed upon by whom?

5 A Between all parties in the discussion, ESR, the place where  
6 we took the inspection, me, defense.

7 Q Well, at one point ESR offered you 36 hours, 36 hours that  
8 were requested by defense counsel, correct?

9 A Yeah, I believe that was discussed at some point.

10 Q Okay. So ESR said we will make the source code available,  
11 how long do you want it for, defense counsel said how about  
12 give us a quote for 36 hours, right?

13 A That sounds right, yes.

14 Q But you only used 20 of them, right?

15 A A little over 20.

16 Q A little over 20 then you produced this not comprehensive  
17 or complete report, correct?

18 A Correct.

19 Q This isn't the first time that you've been given access to  
20 source code but haven't actually spent the time looking at it,  
21 is that right?

22 A I don't follow.

23 Q Do you recall your testimony in the Simmer case?

24 A The Simmer case. Out of Nebraska?

25 Q I believe so, yeah, do you recall that?



## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 A Yes.

2 Q Do you recall being asked, now you're aware that was a  
3 TrueAllele case, right?

4 A It was a hearing in the trial itself.

5 Q But it involved TrueAllele, not STRmix.

6 A Correct.

7 Q And you were asked, Now you're aware that TrueAllele Cyber  
8 Genetics says, "Okay, you can look at our source code. You're  
9 aware of that now, correct?" And you answered, "I'm aware of  
10 the offer. Question. But yet you haven't looked at that  
11 source code yet. Answer. Correct. Question. So you've been  
12 asking for something. I want to see this. I want to see it.  
13 And now you can see it and you're not looking at it. Correct?  
14 Answer. I've been asking for it for three years and I have had  
15 the opportunity for five months. Question. And haven't taken  
16 that opportunity in the past five months. Answer. Not yet."  
17 Do you recall that testimony from the Simmer case?

18 A It sounds familiar.

19 Q Okay. Would you like to see the transcript of it?

20 A No.

21 Q All right. Do you remember the Washington case that I  
22 asked you about earlier?

23 A This is the Washington case out of Pennsylvania?

24 Q Correct, the defendant is Washington, you testified in  
25 Pennsylvania. That's the case. Was there a similar situation

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1       there where you didn't actually run the review on the materials  
2       you had been given?

3       A     Well, that's different. The source code at that time was  
4       not available. I believe that policy change, to the best of my  
5       memory, that policy change in the Cyber Genetics organization  
6       occurred late summer, early fall last year in the Washington  
7       case, so there was no source code offered to me.

8       Q     Was the software offered to you to be able to work with?

9       A     A portion of the software. TrueAllele is a different  
10      architecture perhaps than STRmix. STRmix is a desktop program  
11      that can be run on a desktop computer. TrueAllele is a client  
12      server architecture, so it has a client program that allows you  
13      to input data. So that's what was offered to me, not the  
14      entire deconvolution, LR calculation; the whole set of  
15      TrueAllele programs were not offered to me.

16     Q     But you didn't run the data in that case either, based on  
17     what was offered to you, correct?

18     A     I did not.

19     Q     So it's a bit of a theme, you get access to materials but  
20     you don't spend the time to actually go through them to figure  
21     out whether it works properly or not.

22     A     I can't answer all of those questions with the levels of  
23     access that I've been given.

24     Q     You have testified here today that you were never offered  
25     access to Github, right?

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 A Right.

2 Q Did you ask for access to Github?

3 A I asked for assess to the validation materials.

4 Q When you saw what had arrived, did you say, hey, I would  
5 like to see a few more things, can you get me these other  
6 things? Did you ever ask them?

7 A Well --

8 Q That's a yes or no. Did you ask them for additional  
9 information after you saw that there wasn't everything there  
10 that you would have liked to see?

11 A No.

12 Q Okay. Your report also repeatedly says that several things  
13 are unclear. Is that correct?

14 A In this case?

15 Q Yeah, the report in this case.

16 A Yes, sir.

17 Q And is it possible that several items weren't clear to you  
18 because either your lack of training and experience or the fact  
19 that you didn't spend the time to actually figure out what the  
20 answers to those questions were?

21 A I think some things that are not clear could be learned in  
22 time, yes, with more exposure to the materials.

23 Q Now, you testified to Ms. Kloet regarding the location of  
24 bugs, the identification of bugs in software generally and in  
25 STRmix in particular, correct?

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 A I did.

2 Q And my question for you is debugging common as software is  
3 continuously developed over time, new versions of software are  
4 rolled out?

5 A Is debugging --

6 Q Yeah, is debugging a common feature of ongoing software  
7 development?

8 A This is a pedantic point, but debugging is a term of art  
9 that I'm not sure applies here. It's a tool.

10 Q I'm not a computer scientist so maybe I'm using it  
11 incorrectly. What I'm trying to figure out is is it common as  
12 new versions of software are released, complicated software,  
13 that those versions are sometimes released because little  
14 problems are identified and you need to fix them and that's why  
15 you push out a new version of software? Is that fair?

16 A There's patches and upgrades, yes, that's common.

17 Q Now, for the various errors or criticisms that you said you  
18 found in STRmix, did you attempt to figure out whether or not  
19 those actually had a material impact on the operation of the  
20 software in this case?

21 A No.

22 Q Have you testified before that that's something your lab  
23 does, actually run the software to figure out what the answer  
24 is?

25 A What software?

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 Q Well, whatever software you're looking at in a particular  
2 case, that that's something you do, you get the software, you  
3 get the data and you look at it to see if it was done correctly  
4 in that case; is that a service offered by your firm?

5 A I think that's a very broad question. We have software  
6 that laboratories use. We use that regularly in reviews. We  
7 have not used STRmix to come up with alternative likelihood  
8 ratios if that's what you're asking.

9 Q Do you actually run the program, STRmix, that's my  
10 question?

11 A I have before. I have not in case work.

12 Q And why didn't you try to figure out in this case if any of  
13 these stylistic criticisms you had actually made a difference  
14 to the bottom line?

15 A That wasn't the goal, the main goal of my inspection.

16 Q That wasn't the scope of work provided to you by defense  
17 counsel?

18 A I'm sorry?

19 Q That wasn't what you were asked to do.

20 A I'm not sure if we were asked to do that and given that was  
21 our primary charge. We certainly had conversations about what  
22 I ended up doing.

23 Q Okay. So I'm trying to move along, Your Honor. You've  
24 testified previously that the most variants you would expect to  
25 see in multiple runs of STRmix is one order of magnitude?

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 A On the same set of input data with no other parameters  
2 changed.

3 Q Right. You run it again, the Monte Carlo engine might  
4 produce something that's off by one quarter magnitude, correct?

5 A Yes.

6 Q And you still agree with that as you sit here today?

7 A Generally.

8 Q You agree and you've testified previously that internal  
9 validation is an appropriate thing to do to test software,  
10 right?

11 A Yeah.

12 Q Do you agree that of the probabilistic genotyping software  
13 you've reviewed, not just STRmix, but all other probabilistic  
14 genotyping software, STRmix probably comes closest to meeting  
15 the IEEE standards?

16 A Yes, I would.

17 Q Let me briefly ask you about a couple of these exhibits  
18 that Ms. Kloet introduced. Do you have PP in front of you?

19 A Yes. Is that the Benschop article?

20 Q It is, yes. You do have it in front of you?

21 A Yes, sir.

22 Q Was STRmix the software model used in generating this  
23 article?

24 A No.

25 Q What model was used?

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 A This was the probabilistic genotyping program itself. I  
2 believe this was LRMix.

3 Q Right. That's what says in the abstract, LRMix, if we  
4 zoomed in here.

5 A Yes, sir.

6 Q Okay. And the conclusions of the paper then are based on  
7 the model; if STRmix were studied, the conclusions in the paper  
8 might be different, right?

9 A It's possible.

10 Q Now, can we go to page 95 of the paper which is the fourth  
11 page of the paper? And look at this area down here in the  
12 bottom left-hand corner. Do you see the portion where it says,  
13 "In most instances, the likelihood ratios were equal or larger  
14 for hypotheses that used the true number and not an incorrect  
15 number of contributors."

16 A I see that.

17 Q I read that accurately?

18 A Yes.

19 Q Do you think that statement is consistent with the idea  
20 that a wrong number of contributors leads to a conservative  
21 result?

22 A Not universally, but this is, this starts with "in most  
23 instances," that's a generalization for the majority of the  
24 cases.

25 Q In most instances, right, that's all I'm saying. It's

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 consistent with that in most instances, right?

2 A That's what it says, yes.

3 Q Now, can we bring up Defense Exhibit AA which you were  
4 asked about? Finding 4. It seemed like you said you were  
5 confident that miscode 3 affected this version; it was less  
6 clear whether these other ones did, but 4 might have in your  
7 opinion based on your review of this document. Right?

8 A Could I rephrase that?

9 Q Sure.

10 A It's been mentioned by witnesses other than me that 3  
11 applies to the version and could potentially affect results in  
12 this case. It seems like the consensus is that it doesn't  
13 really. The other --

14 Q Are you talking about 3 or 4?

15 A 3.

16 Q Okay.

17 A 4.

18 Q I only want to look at 4. I know other witnesses testified  
19 about 3. I think you're the only witness who thought 4 might  
20 have an impact on this version. I just want to highlight for  
21 you that the conclusion of the study of 4 was that there was no  
22 detectable effect on the likelihood ratio in the profiles  
23 tested, right?

24 A Where is the conclusion?

25 THE COURT: On the right-hand side.



## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 THE WITNESS: Okay.

2 MR. PRESANT: I read that accurately?

3 THE WITNESS: Yes, you did.

4 MR. PRESANT: Okay. Ms. Kloet asked you about the  
5 confusion about the Markov Chain Monte Carlo issue that has  
6 gone back and forth in these battling reports. You said you  
7 were educating yourself on whether or not you were right about  
8 that, right?

9 THE WITNESS: Did I?

10 BY MR. PRESANT:

11 Q Never mind. I'll move on. I'm almost done here. You  
12 testified about how Niche Vision is currently being used to  
13 code, right?

14 A They were referenced in the change request.

15 Q And you thought their portions of the code were quote  
16 "tidy, well maintained," close quote, right?

17 A The ones attributed to those two gentlemen.

18 Q But yet there's still been bugs or issues found with that  
19 professional, professionally developed code, right?

20 A The disclosure is not that descriptive of which portions,  
21 who was ultimately responsible for those.

22 Q So even professional coders sometimes create bugs that then  
23 need to be worked out in later versions. I mean do you  
24 disagree with that general idea?

25 A Professional coders are not immune to making mistakes.

NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 Q All right. Last set of questions. Your firm has its own  
2 software, right?

3 A We do.

4 Q Is that software called Genophiler?

5 A One of them.

6 Q I just want to ask you about Genophiler. Can we bring up  
7 Government's Exhibit 24? It's in the other book in front of  
8 you but we will put it on the screen. Do you recognize  
9 Exhibit 24?

10 A It's our website.

11 Q And this is specifically the page on Genophiler public  
12 validation, right?

13 A Yes, sir.

14 MR. PRESANT: Your Honor, the government moves to  
15 admit 24.

16 THE COURT: Ms. Kloet.

17 MS. KLOET: I have no objection.

18 THE COURT: It's admitted.

19 MR. PRESANT: Can we go to the next page, please?  
20 Actually the page after that, I'm sorry. No, the page before.  
21 It's right above results here. Thank you. Do you see this  
22 journal article referenced on the validation of Genophiler?

23 THE WITNESS: I do.

24 BY MR. PRESANT:

25 Q And is D. Krane, Daniel Krane is your boss at FBS?

## NATHAN ADAMS - CROSS EXAMINATION - MR. PRESANT

1 A Dan Krane, yes.

2 Q I'm sorry, Dan Krane. So he validated his own software,  
3 Genophiler, in this case, right, that's the result advertised  
4 on your website, correct?

5 A This, this is the publication for a paper on analytical  
6 thresholds.

7 Q Okay. Is the validation discussed anywhere like who  
8 actually did the validation on this website?

9 A It's likely to be a group consisting of those people. It  
10 was before my time.

11 Q Okay. So Professor Krane might have been the one who  
12 validated Genophiler, that sounds right to you?

13 A He would have been involved in the development. I don't  
14 know who conducted the validation.

15 Q You testified that independence in validation is extremely  
16 important: Financial, different person, different technical  
17 specifications, all this stuff about independence, right? But  
18 it seems like Genophiler wasn't independently validated. So my  
19 question for you is there one set of standards for software  
20 developed by other companies and a different set of standards  
21 for software developed by your company?

22 THE COURT: I think he testified that he didn't know  
23 who did the validation.

24 BY MR. PRESANT:

25 Q I'm sorry, give me a moment, Your Honor, please.

## NATHAN ADAMS - REDIRECT EXAMINATION - MS. KLOET

1 THE COURT: He just said that. The question, "So  
2 Professor Krane might have been the one who validated  
3 Genophiler." The answer was, "He would have been involved in  
4 the development. I don't know who conducted the validation."

5 MR. PRESANT: Let me ask you about your testimony in  
6 the Fair case. Do you remember testifying in that case about  
7 Genophiler?

8 THE WITNESS: It's come up before. I don't  
9 specifically in that case.

10 BY MR. PRESANT:

11 Q Do you recall being asked, "Question. So it's actually, so  
12 the people who validated it are the same ones that created it  
13 and they had access to the source code? Answer. Correct.  
14 Question. Do you know if the source code has been given to  
15 anyone else to validate it? Answer. I don't know." Do you  
16 recall that testimony?

17 A Correct. Yes.

18 Q So you acknowledge there that the same people who created  
19 the software were the ones who validated it, right?

20 A Right. I can't give you an author list of who conducted  
21 the validation. I'm sure Jason Gilder was involved, and it  
22 would be reasonable to expect that other people who developed  
23 the software were involved in its validation.

24 Q So my question for you is the independence requirements  
25 that you testified about aren't even applied by your very own

## NATHAN ADAMS - REDIRECT EXAMINATION - MS. KLOET

1 firm with respect to their software, is that right?

2 A That's going to be based on the significance of the  
3 software.

4 Q I'm not asking about the significance. I'm just talking  
5 about the application of the independence principle, not even  
6 followed with respect to Genophiler, right?

7 A I would not agree with that.

8 Q All right.

9 MR. PRESANT: Nothing further, Your Honor.

10 THE COURT: Just so everybody is aware, I'm going to  
11 give a brief opportunity to redirect and recross, not to exceed  
12 a total of ten minutes and then we are done.

13 MS. KLOET: Absolutely, Your Honor. I only have two  
14 brief topics.

15 REDIRECT EXAMINATION

16 BY MS. KLOET:

17 Q Ideally how long would a review of materials like you did  
18 for STRmix in this case, ideally how much time would you want?

19 A I think it could take weeks or months. As I said, it could  
20 be a significant portion of the original development budget and  
21 accordingly a review of these processes could take quite a  
22 while.

23 Q Is it your understanding that FBS, the company for which  
24 you work, they charge by the hour for your work?

25 A Yes, we do.

1 Q Is it your understanding that ESR charges by the hour?

2 A Yes.

3 Q Where did you take or where did you conduct your review?

4 A At a law office.

5 Q At a private law firm?

6 A Yes, sir. Ma'am.

7 Q Was anyone present during your review?

8 A Yes, I had a minder, I suppose.

9 Q When you say minder, was that someone from your company or  
10 from ESR or from another entity?

11 A From the law office.

12 Q Moving on to the next topic. If you can go to PP, Defense  
13 Exhibit PP this is the Benschop article. Have you reviewed --  
14 have you reviewed any other research articles that address the  
15 issues that are addressed in this particular paper?

16 A Yeah. The effects of varying the number of contributors.  
17 There have been a number of publications involving those kinds  
18 of inspections.

19 Q And does that other research indicate that varying the  
20 number of contributors can affect a likelihood ratio  
21 potentially to the detriment of the defendant?

22 A Yes.

23 MS. KLOET: Thank you. That's all.

24 MR. PRESANT: Your Honor, I have no recross of this  
25 witness. The one issue I will raise with the Court, and I

1 really wish we had more time is just some of the new exhibits  
2 today, if we had more time I would like to show to  
3 Dr. Buckleton so he could explain their relevance if any for  
4 STRmix. And I would call him in rebuttal if we had additional  
5 time. But I'm not sure the Court or the witness's schedule  
6 permits to continuing this to tomorrow. So I just want to put  
7 that on the record for what it's worth.

8 THE COURT: Well, we don't have more time. You have  
9 taken up an entire two days. We have heard a lot of testimony.  
10 I think that with my opportunity to review my notes, and the  
11 rough of the transcript, I think I have heard enough to make a  
12 decision. I don't think we need rebuttal. And I'm not going  
13 to permit any.

14 We have a lot of material to digest. And what we are  
15 going to do, what you are going to do is provide me with  
16 supplemental briefing within some important limitations.

17 First of all, I want to make sure that everybody is in  
18 agreement with the requirements of Daubert. That is, are you  
19 both in agreement that Daubert requires the Court to examine  
20 the evidence in question and determine whether the method used  
21 to produce it was scientifically valid, and that the results  
22 are valid and relevant. So I'm asking both of you to put your  
23 either agreement or disagreement on the record that that's the  
24 fundamental duty of the Court under the Daubert decision.

25 MR. PRESANT: You want it on the record now or in the

1 supplemental briefing?

2 THE COURT: Right now.

3 MR. PRESANT: Your Honor, I believe that's correct.

4 Daubert applied Rules 701 through 703 are interpreted and set  
5 forth some non exhaustive list of factors, four or five of  
6 those depending on which authority you look at, are considered  
7 usually discussed as the Daubert factors. Off the top of my  
8 head, it's whether the method has been subject to peer review  
9 and publication, whether the method is capable of being tested,  
10 whether the known error rate or the known potential error rate  
11 has been tested or could be tested, and then the Frye standard  
12 was incorporated too, general acceptance within the scientific  
13 community.

14 And so I think those factors all go to the way the  
15 Court has framed the issue. Whether -- I do think it's  
16 appropriate for the Court to examine the evidence that's been  
17 presented, the literature, and all the exhibits, and  
18 attachments to the briefs; I do think that's the role of the  
19 Court to examine that material in order to answer the Daubert  
20 question about whether the evidence should come in, and I think  
21 that goes to the validity issue as well. And of course  
22 relevance comes in both under the 700 series of federal rules,  
23 the expert rules, because the expert's testimony has to assist  
24 the trier of fact. This Court of course knows its gate keeping  
25 function under the relevance rules in the 400 series too.



1                   So that's the government's view on those two questions  
2                   if it's responsive. If it's not, I'm happy to address  
3                   additional questions.

4                   THE COURT: No, it is. Ms. Kloet.

5                   MS. KLOET: Your Honor, if I understand the Court  
6                   correctly, the two driving principles that are cited in Daubert  
7                   that are found in the Federal Rules of Evidence are reliability  
8                   and relevance. I think that's what the Court stated on the  
9                   record today. We would agree with that and rely on the Daubert  
10                  elements as set forth in the case itself.

11                  THE COURT: Okay. And here's how it's going to go.  
12                  We are going to have a defendant's brief which will be due  
13                  within, in 48 days or 45 days, and that brief must articulate  
14                  the specific grounds on which the defense objects to the  
15                  admissibility of the evidence. I think that that has been a  
16                  little fuzzy in this case. I think it has been a little bit of  
17                  a moving target. And it's really important that you articulate  
18                  specifically what the grounds are that you base your objections  
19                  on.

20                  Then I want you to tell me what testimony or evidence  
21                  that has been produced in these last two days which supports  
22                  your position on admissibility or inadmissibility, and why  
23                  under the governing legal standards. And also, you know, to  
24                  drop the other shoe, what the contrary evidence is.

25                  Then within 45 days of the defendant's brief, the

1 government can respond. There's not going to be any reply  
2 allowed. Both briefs must identify the three most important  
3 documents that have been introduced here. There's really been  
4 a great deal of very technical, scientific documentation in  
5 this case, some of which I've read, much of which I have not.  
6 But it is not possible for either me or my law clerk to read  
7 all of it. And so I need for you to tell me, each of you to  
8 tell me what are the three most important supporting documents  
9 to your positions. And you're going to do all of this in  
10 20 pages or less.

11 Are there any questions, comments, concerns? Kathie,  
12 have you got something else?

13 We do have a waiver of the speedy trial clock.  
14 Mr. Gissantaner, are you willing to extend your waiver until  
15 the briefing and opinion drafting in this case are concluded?

16 THE DEFENDANT: Am I understanding right when you say  
17 the 45 days, is my attorney, Ms. Kloet, takes 45 days to write  
18 her brief, and then he get 45 days to respond? So in total we  
19 talking 90 more days.

20 THE COURT: Well, but then I've got to read the briefs  
21 and write an opinion.

22 THE DEFENDANT: I'm cool with that.

23 THE COURT: Okay. Thank you. Anything else? Okay.  
24 Thank you all for your presentations. We are adjourned for the  
25 day.

1 THE LAW CLERK: All rise. Court is adjourned.

2 THE COURT: As we did yesterday, the clerk is going to  
3 read her list of the exhibits which she has that were admitted  
4 today and each of you should check your own list to determine  
5 whether she has the same ones that you have.

6 THE LAW CLERK: For the government, I have Exhibit 16,  
7 and Exhibit 24.

8 MR. PRESANT: That's correct.

9 THE LAW CLERK: Okay. For the defense I have Exhibit  
10 A, B, D as in David, E, L, P, Q, V as in Victor, then AA, LL,  
11 MM, and PP.

12 MS. KLOET: Double C admitted? We discussed that  
13 today.

14 THE LAW CLERK: I have that as yesterday.

15 MS. KLOET: I'm sorry. Okay. And you got PP listed.

16 THE LAW CLERK: Yes, PP.

17 THE COURT: Okay. Now we truly are adjourned.

18 (Proceedings concluded, 4:42 p.m.)  
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## REPORTER'S CERTIFICATE

I, Kathy J. Anderson, Official Court Reporter for the United States District Court for the Western District of Michigan, appointed pursuant to the provisions of Title 28, United States Code, Section 753, do hereby certify that the foregoing is a full, true and correct transcript of the proceedings had in the within entitled and numbered cause on the date hereinbefore set forth; and I do further certify that the foregoing transcript has been prepared by me or under my direction.

/s/ Kathy J. Anderson

Kathy J. Anderson, RPR, FCRR

U.S. District Court Reporter

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